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Prices cut for June! ideA

The *ideA* range of hard disc upgrades is being welcomed as the best way forward for Archimedes and A3000 users. "IDE is the small-computer drive standard for the future," says RISC User. "ST506 is on the way out; SCSI has only a limited future in the small drive market."

PERFORMANCE

IDE is the only true 16-bit hard disc system currently available for Archimedes computers. All data transfers are 16-bit all the way from the disc, through the interface, to the computer (except that the A3000 internal interface has an 8-bit link to the computer).

FLEXIBILITY

An *ideA* system can turn your A3000 into a 20, 40 or 60 Mb workstation with no external attachments, using hard discs which sleep quietly during periods of inactivity.

The *ideA* system caters for two low profile hard discs in the same internal or external housing, allowing you to build up your capacity in easy stages without wasting money.

Then there's the *ideA* 'hard card' option – a 2½-inch hard disc on a standard podule.

VALUE

We think *ideA* upgrades offer the best value for your money, and we aim to keep it that way. Advanced IDE disc technology means simpler, cheaper, more reliable interfaces. Manufacturers' prices for hard discs fall gradually, and we pass these savings on to you as soon as we can.

Our upgrade prices include controller cards and fans where needed. Our disc cases are of metal construction.

RELIABILITY

The first *ideA* customers have been using the system successfully since last year. The A3000 internal hard disc is particularly reliable – not one has had to be returned to us.

The latest IDE discs are ruggedly designed with lap-top and portable computers in mind. You'll wait a long time to see a defect! A skilled service team is ready to back up our guarantee should the need ever arise.

COMPATIBILITY

The Micro User reported "no difficulty in running all fully RISC OS applications". Our IDE filing system is no different from ADFS in use, though it has a few extra features such as the facility to write-protect a hard disc. DOS partitions can be created for the PC Emulator.

CONTINUED SUPPORT

The coming months will see the introduction of many new IDE products, including tape streamers and removable discs. You may rest assured that our software and hardware will keep pace with these developments. Updates for existing users, if they ever become necessary, will be simple and cheap.

"A beautiful solution," said BBC Acorn User. Study our price list elsewhere in this magazine, and let us solve your storage problems too.

Be in at the beginning!

Other products too good to miss!

See our other advert for prices



TWO (Task and Window Organiser)

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Do you wish your pupils were able to start work without understanding the Desktop? With TWO they will be.

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TWO is far more than a 'sticky backdrop'. Its easy-to-use features make the Desktop a friendlier environment and will really save you time.



DrawBender distorts Draw files to follow a shape of your choice. A useful addition or cheap alternative to Poster, supplied with these three decorative fonts.

DrawBender is simple to use, without any complex menu structures. The example above uses DrawBender with **FontFX** – the two make ideal companions.



Baildon Electronics Oddules open the way to cheap, flexible and almost unlimited external expansion via the I^2C bus already supported by RISC OS. Baildon are producing a range of Oddules which may be daisy-chained.

Ready now is the ***AnDi*** Oddule. It has eight digital I/O channels with high current open collector drivers, four A/D inputs, and one D/A output. AnDi is capable of emulating user and joystick ports, allowing ADVAL operation from BASIC, and the use of Concept Keyboards and analogue or digital joysticks.

Cross-32 Meta-Assembler

This professional table-based cross-assembler works with over 50 target processors (including ARM2 and 3), and has been used for some time on PCs. A RISC OS Desktop version by Baildon Electronics is now available. Cross-32 is user-friendly and supports conditional assembly and macros. Output is in absolute binary, or Intel or Motorola Hex formats (ideal for eprom programmers and emulators).

You can modify the tables supplied or add new ones to cater for new processors and opcodes.



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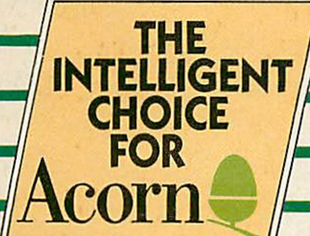
PRODUCED ON THE ARCHIMEDES

All the editorial pages in BBC Acorn User are produced on a DTP system using Acorn Archimedes 440/1 and A540 computers, Computer Concepts' *Impression 2* with Laser Direct printers and Taxan monitors









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3D CONSTRUCTION KIT FOR VIRTUAL REALITY ON ARC

DUE FOR Autumn release, Domark's *3D Construction Kit* will enable Archimedes users to build solid, three-dimensional model environments, and then 'walk into', explore and interact with them.

The idea of solid 3D graphics is nothing new, but this is the first system to allow such free interaction in real-time, and represents a significant breakthrough.

The package has been developed by the 3D professionals at Dimension International and Incentive, and is closely based around the company's existing *Freescape* mainframe software, which has been used for a new TV gameshow, *Cyberzone*, the pilot episode of which will be hitting our screens in the next few months.

The package is far more than just a 3D object designing system – the mainframe version is actually a very high-end virtual reality software system, of the type used to generate the worlds inhabited by those who don the head mounted displays in arcade games such as those made by W-Industries. Since I saw this professional version running at a stand at the Computer Graphics '90 show last year, the system has been converted to the Archimedes. The Arc version is tipped to be the fastest and most powerful conversion of the software, and approaches the 25 per second frame-rate of its big brother.


3D MODEL OF HOME...


...AND OFFICE SPACE

A specially-written, full size arcade adventure game will be included with the package, and this will display some of the more impressive features of the kit. These include the ability to design environments through which any number of people can 'travel', down to a real resolution of 1mm within a very large area.

Through the use of a zoning system, the computer minimises the time taken to plot a scene based on what it knows is visible. For example, the separate rooms inside a building would be isolated zones. Objects do not have to be fixed and can also be animated for greater realism. This means that fully controllable vehicles can be designed and driven.

There are currently several Arc virtual reality hardware developments in progress, and if in the future the towns and cities that will be created with the *Construction Kit* were combined with future hardware developments, it would result in a very powerful, and relatively cheap, system. Domark estimates a £50 price tag for *Construction Kit*.

Mat Tizard

'SATISFACTORY' YEAR FOR ACORN FORTUNES

ACORN claims to have had a 'satisfactory' year in 1990, particularly in the education market, which held its own compared with the general downturn in the computer market.

In the 12 months to December 31 1990, revenue was slightly higher than in the previous year (£45.5m compared to £44.9m in 1989). Whilst the operating profit before exceptional items rose by over 50 per cent to £2m (£1.3m in 1989), pre-tax profits fell by 38 per cent from £2.53m in 1989 to £1.58m.

Acorn sold intellectual property rights to Advanced Risc Machines (Arm) Ltd for £1.5m and made a provision against bad debts due from one of the company's major customers of £0.9m. Interest charges rose to £1m in 1990. Extraordinary charges of £0.56m on two investments held since the mid-1980s were also incurred.

Acorn cited its main achievement as maintaining its leading position in the UK education market.

Some 53 percent of all computers delivered to UK schools were Acorn systems, with the BBC A3000 and Archimedes outselling the eight-bit BBC Master by a factor of two-to-one. Acorn systems have now been installed in 85 percent of all UK schools.

PC EMULATOR READY?

VISITORS to the recent CD-Rom '91 exhibition in London were given a sneak preview of the new multi-tasking version of Acorn's Archimedes software PC emulator.

Cumana, which is in the CD-Rom drive business, was demonstrating the possibility of Dos- or Apple Mac-based software being opened to the Archimedes via the new emulator. Other firms, such as Next Technology, will now be able to open up sales initiatives into education as soon as Acorn releases the new PCE.

The new software will run *Windows 3*, albeit slightly sluggishly, but Cumana proved at the exhibition that it was perfectly usable.

NEWS IN BRIEF

● **TWO** new Public Domain libraries for the Archimedes/A3000 are Arch PD and Arch Angel PD. Arch PD has 100 discs in its catalogue, which can be obtained by sending an SAE and disc to Adam Case, Arch PD, 109 Ferry Road, Hullbridge, Hockley, Essex SS5 6EL. Arch Angel PD offers a pick-and-mix service where for £1.50 the buyer chooses the software required from a list that includes graphics, demos, music, samples, comms, and so on. Ready-compiled discs are also available at £1.10 each. Send for a free catalogue to Arch Angel PD, 9 Chancel Court, Chancel Lane, Pinhoe, Exeter, Devon EX4 8QE.

● **IF YOU** live in Derbyshire, you may like to know that the newest Acorn dealer in your area is Selective Computer Services. The company can be contacted on (0332) 690691.

● **ZCL**, the Acorn distributor to the computer industry, has been nominated distributor of the year by computer retailers and resellers in the UK. ZCL's chairman, Don Carter, acknowledged the honour, but added that the quality of Acorn's product played a major role in the company's success.

● **EVANGELTRUST**, which produces bible-based computer games and databases, has launched a competition to write a piece of Christian software which could be used by RE teachers, ministers, youth groups, and so on. The closing date for entries is December 31 1991. For further details and entry forms send an SAE to Bible Software Competition, Evangeltrust, PO Box 224, Kingston upon Thames, Surrey KT1 2NX.

● **FADED** prints are usually the result of a depletion of ink on the fabric printer ribbon – now the Maxiprint Ribbon Re-inker can replenish the original ribbon up to 50 times. The Maxiprint can accommodate a wide variety of ribbon cartridges, and the ink cartridges used are available in a wide range of colours. With the optional Twin Cartridge Adaptor the inker can be made to ink two- and four-colour ribbons. Contact Digitone, Hagan deg, Llys y Coed, Mountain Road, Pembrey, Dyfed SA16 0AJ.

● **THE** Electronic Font Foundry has just released its range of Indian fonts, including Bengali and Punjabi. Contact EFF on (0344) 28698.

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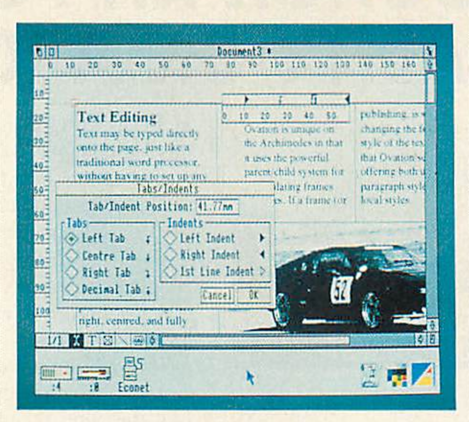
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Adding style is simple

Ovation provides user-defined paragraph styles and easy-to-use local effects that give instant control and can be mastered in a matter of minutes! A wide range of styles are available allowing you to create documents with a distinctive appearance. Very accurate typographical control is provided, making Ovation suitable for the most demanding professional applications.

Extensive graphics

An extensive range of features is provided for manipulating graphics. Paint and Draw format pictures may be imported from scanners, digitisers and drawing packages etc. and may then be instantly enlarged, reduced, cropped as required. With line drawing facilities and definable border styles, Ovation provides features virtually unheard of in its price range.

Laser-sharp printing

Ovation uses the RISC OS printer drivers to produce high quality printing on dot-matrix, ink jet and laser printers. It prints pages exactly as they are created on the screen, at the highest resolution your printer can deliver. The PostScript driver allows for the printing of documents on high quality laser printers and typesetting machines.

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Ovation contains a fully integrated high speed spelling checker with a dictionary of over 60,000 words and a host of other features. You can even edit the main dictionary. Requires 2Mb.



The Ovation package includes a 250-page user guide for both novices and experienced users alike, a quick reference card listing all the keyboard and mouse short cuts, 7 outline fonts (22 faces), and a range of clipart.

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SUCCESSFUL PRES-ENCE AT COMPUTER SHOPPER SHOW

VISITORS who flocked to the recent Spring *Computer Shopper* Show at London's Alexandra Palace were greeted with new Acorn products from Pres for the BBC A3000.

A dual podule box for the A3000, launched by Pres, allows the use of a scanner and a hard disc card together for the first time.

The A3000 can normally be expanded by adding a single standard-sized expansion card to the rear. But because the cards are intended for 400-series machines, they need to be protected in a podule case on the A3000.

The A3000 normally supports only one such podule, although some external system housings allow you to switch manually between two or more.

Pres' new box can be fitted in the normal way to the rear connector on an A3000, but makes an additional connection inside the machine to allow Risc OS to address two separate cards automatically.

The system works exactly the same as it does on a 400-series machine and allows simultaneous use of a scanner and hard disc card.

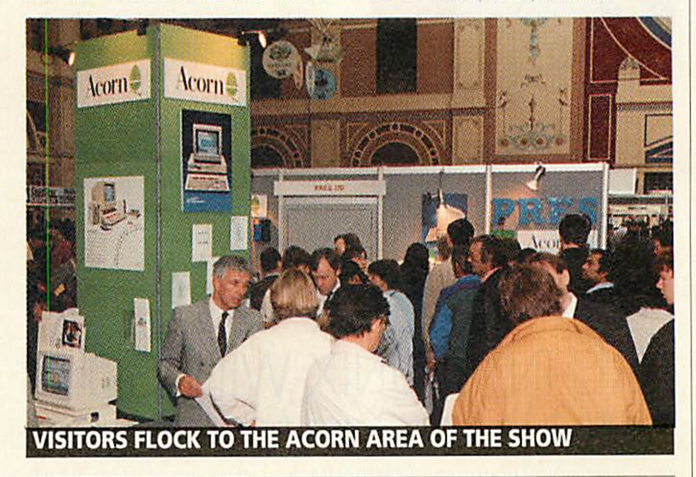
Also released by Pres at the show was a 10Mbits per second link between two Archimedes. The Missing Link board slots into the Econet interface space, and provides very fast communication between two machines. The physical link can be a special serial cable, or fibre optic for longer distances.

The Missing Link can also act as a filing system – files dropped into a filer window on one machine appear in a similar window at the other end of the link.

Possible uses include swapping large sprite files or scans between machines where an Econet would be too slow and Ethernet too expensive.

● Pres has also announced that it is knocking £100 off the normal advertised prices of its 20 and 40Mb hard disc upgrades. The units come complete with the ST506 (Acorn) expansion card and all cabling and instructions.

Further details can be obtained from Pres Ltd, Box 319, Lightwater, Surrey GU18 5PW. Tel: (0276) 72046.



VISITORS FLOCK TO THE ACORN AREA OF THE SHOW

CANADIAN VISIT

REPRESENTATIVES of UK educational software producers have just returned from a sales initiative aimed at spreading the Acorn message in Canada.

The group – including Paul Richardson from ExpLAN, David Tee from Oak Solutions, Peter Stibbons from Anglia TV – gave seven major presentations of Archimedes hardware and software at venues like the Educational Computing Organisation of Ontario. Working with Paul Richardson was a team of 18 pupil demonstrators from Toronto schools who were trained (by fax!) from the UK.

In excess of 200 enquiries and orders were taken.

A3000 SPECIAL ACCESS

A NEW Special Access Pack has been launched by Acorn for people with disabilities and learning difficulties. Centred around the BBC A3000, the package is fitted with an Acorn serial and Morley user/analogue upgrades to enable the use of devices such as the Concept Keyboard and touchscreen.

A special utilities disc offers useful programs which can: emulate mouse movements using the numeric keypad; access other programs via a special switch input; convert the normal screen pointer to a larger size; magnify the screen to allow print and images to be seen more easily; allow text character input from a selection panel; create a flashing caret with a 'homing device' to make it easier to locate within a document.

Also included in the package is an overview booklet and a Special Needs Computing Handbook complied by Northwest Semerc in association with ACE centres. The handbook contains useful and relevant information, including sources of supply for accessories and details of the many applications available. The A3000 Special Access Pack is assembled and tested by disabled people who work for the Papworth Group of Industries in Papworth, Cambridgeshire. Priced at £795, registered disabled people and charities may obtain a £100 reduction from participating dealers upon production of their registration cards. Contact Acorn on (0223) 245200.

NEWS IN BRIEF

● **AWARE** of a lack of educational software to motivate older children with learning difficulties, Sherston Software has just released Sellardore Tales.

This is an exciting adventure with a high interest and low reading age. It is aimed at children who are aged 11 and over, but who have a reading age of about eight, and supports English AT 2 in the National Curriculum.

The computer adventure, Black River Quest, is accompanied by an illustrated book with 13 chapters which introduces the reader to the world of Sellardore and the main characters who reside there.

The package costs £24 and contains photocopiable activity sheets based around the book and game, as well as creative writing cards.

Contact Sherston Software, Swan Barton, Sherston, Malmesbury, Wiltshire SN16 0LH for further details.

DIARY DATES

● **JUNE 22** The All Formats Computer Fair will be held at the New Horticultural Hall, London.

● **JUNE 25-27** Multimedia is holding the first European multimedia conference at Olympia 2, London, with talks on the mass market, educational applications and multimedia in business. Running alongside this will be the Multimedia 91 exhibition – the first event to demonstrate what multimedia is, and to show what it could do for your company. The conference costs £875.37 (£346.62 with academic discount). The exhibition is free, but by ticket only. Contact Jacqueline Wilson/Lynne Davey on 081-868 4466 for more details.

● **SEPTEMBER 5-8** The European Computer Entertainment Show takes place at London's Earls Court 2.

● **OCTOBER 11-13** The highlight of the year will the BBC Acorn User Show, which takes place at the Wembley Conference and Exhibition Centre in London. Opening times will be 10am to 6pm on Friday and Saturday and 10am to 5pm on Sunday.

For further details on show ticket prices and availability, keep an eye on BAU or contact Safesell Exhibitions on (0737) 814084.



BRING WORK HOME WITH NEW A3000 OFFICE SUITE

A NEW A3000-based home office package, priced at just under £650, has been launched to cater for the home office and small business user.

Acorn distributor Bonsai Lightning and Devon-based Minerva Software have combined to produce a special package, called the Home Office Suite, which includes a BBC A3000 and Minerva's *Desktop Office* software.

The latter is a fully integrated suite of database, wordprocessor, spreadsheet, charts and communications for the A3000/Archimedes. Data can be transferred between the programs, making the package a useful choice for education, small business and home use.

To coincide with the Home Office Suite launch, Minerva has produced a new version (1.01) of *Desktop Office* which includes several new facilities.

In the *DTOWord* wordprocessing section, previewing a document will pause at the end of each screen to make reading easier. Page breaks are also shown when previewing documents and there are two new commands to control italics.

In the *DTOBase* database section, marked cards may be selected and deselected using the option on the main menu, as well as the Select option in the submenu. When setting up



a search, you can now place comparison operators in the fields to check for ranges in various ways. There is also a specialist labelling facility.

Ian Goodall of Bonsai Lightning, which is handling distribution to dealers, told *BAU*: 'We have been looking at producing a package like this which fits between the basic A3000 and the Learning Curve. We want to appeal to the home and small business user and possibly tempt BBC Master and model B owners to consider trading up to the A3000 for home use.'

The Home Office Suite costs £649 and, for those without a monitor, a built-in HCCS TV modulator is also available for £39.95.

Anyone wishing to purchase the package should contact their nearest Acorn dealer, who can contact the Acorn division of Bonsai Lightning on 081-963 1399.

TECHNO-I DIGITISES

TECHNOMATIC has released what it claims to be 'one of the most advanced video digitisers currently available'.

The new Techno-I card, with Risc OS multi-tasking software, allows the user to grab a picture from a video source (TV, video recorder, etc) and convert it to a sprite which can then be dragged to other applications, such as art or DTP packages.

Unlike simple RGB video digitisers, Techno-I handles colour in 25 bits, with seven bits luminance and 18 bits chrominance. The on-screen viewfinder displays live colour or monochrome in real-time, can be either 1/16 or 1/4 screen area, and can be offset vertically and horizontally under user control.

Frame buffer resolution is up to 512 × 512, with programmable vertical and horizontal resolution.

Complex frame manipulation features are built into the hardware, including options to grab the current, previous and last completed frames.

The Techno-I costs £249 for the Archimedes 300/400 series and £279 for the BBC A3000. Contact Technomatic Ltd, Techno House, 468 Church Lane, London NW9 8UF. Tel: 081-205 9558.

I/O A3000 EXPANSION

UNILAB has developed an A3000 expansion unit which provides the essential BBC-type sockets. The I/O Box 3000 plugs into the expansion connector on the back of the A3000 and provides three user ports, an analogue port and a 1MHz bus. All the user ports are bi-directional and one has the same number of pins as the BBC printer port. The unit costs £77.58.

For further details contact Unilab on (0254) 681222.



ARC INTO UNIX WILL GO

IN A BID to integrate its standard hardware products onto campus-wide Ethernet networks, Acorn has launched a low-cost Network Gateway Starter Pack. Using an Acorn R140 Unix workstation as the gateway, the package also includes a licence for Acorn's TCP/IP Protocol Suite, providing existing Archimedes systems access to the campus Ethernet. Thick and thin Ethernet and Econet connectors and a range of networking software, including ONC, NFS and TCP/IP are pre-installed. The Network Gateway Starter Pack is priced at £2499.

● Meanwhile, Acorn has also announced a special discount on its Unix platform to lecturers, research staff and academic support staff in further and higher education establishments. Until the end of June, they can buy an Acorn R140 Unix machine for £90 per month, spread over two years. Around 47Mb of compressed software includes full implementation of Unix (BSD 4.3 with System V extensions), X-Window System (version 11), C and Bourne shells and tools, Ansi C and Fortran 77 compilers, programmers and documenters tools, plus a range of connectivity software.

● New software has also been released which allows users of the Archimedes to connect their machines to a network of Unix workstations running the industry standard X Window System. X software from Gnome Computers Ltd, developed in conjunction with Acorn, provides a low cost means of turning an Arc into an X terminal. If loaded onto a BBC A3000, for example, a colour X terminal can be established for under £1500. X comes on a standard 3.5in floppy disc and costs £199.

For further information on all these Unix developments, contact Acorn Computers on (0223) 245200.

RELEASES OF ARC-PCB

NEW RELEASES of *Arc-PCB* from Silicon Vision provide more PCB layout and schematic drawing possibilities.

Arc-PCB Professional V3.1 supports arc and circle drawing for silkscreen and annotation, curved tracks for analogue design, layer swap operations, scaling of components, and so on. The top of the range *Arc-PCB Schematics* V4.1 includes many of the above, plus schematic drawing. V3.1 costs £375 and V4.1 costs £575. Contact Silicon Vision on 081-861 2173.

Announcing a new era in word processing...
EasiWriter for the Archimedes

EasiWriter is a full featured, WYSIWYG multi–column word processor designed specifically to work with RISC OS.

Created by the same team that wrote MacAuthor – the word processor used to write *Tomorrow's World* and by Douglas Adams to write and typeset *Dirk Gently's Holistic Detective Agency* – EasiWriter sets new standards in ease of use and quality of output on the Acorn Archimedes.

Power with ease of use
EasiWriter can be used as a basic wordprocessor for writing short documents, yet has the flexibility to produce complete books or multi-column layouts incorporating sprites and Draw files created by other Archimedes applications.

User friendly
Unique, on the Archimedes, to EasiWriter is a powerful **Undo command** that lets you undo your last action, anything from typing to changing the document's margins.

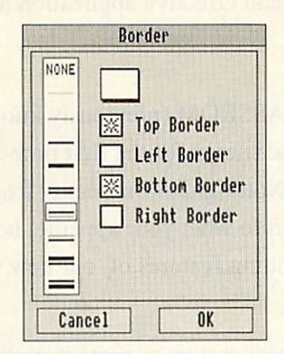
Table editor
Creating attractive tables has never been easier. It's as simple as pressing Tab and Return – no need to set tabs. EasiWriter's built–in intelligence does the rest, automatically adjusting the width of columns as you type.

Production of Hog Casings
(thousand metres)

	1985	
	Jan-Mar	Year
Farm manufactured	67.2	255.0
Abattoir manufactured	92.0	290.3
Synthetic	98.5	1,127.1

Multi-lingual
EasiWriter can hyphenate in all the major European languages and with optional dictionaries can spell check mixed language documents.

Borders command
Any part of an EasiWriter document can have borders added in a variety of styles and line thicknesses.
Rules between columns, sidebars, shadowed boxes – all can be added with a click of the mouse.



Structures
EasiWriter introduces a powerful new stylesheet capability for formatting entire structures – chapters, sections, lists, tables, pictures and figures.

Section Format
Heading Position:
Columns
Number: 3 Balanced
Separation: 0.25 in Justified
Sep. Rule NONE
Start section on next page
Auto Indentation
Changes
Columns:3 + Column rule:On + Heading + Page alignment
Cancel Delete Changes OK

For example a section style can control the position and type specifications of both its heading and paragraphs, the number of columns and separation rules between them, even its language.

Multiple columns
You can have up to nine columns anywhere in a document.
EasiWriter can automatically balance the text between them, keeping the length of each column the same, even as you type.
For even more professional results columns can be vertically justified.

- ❑ **WYSIWYG word processor using outline fonts.**
- ❑ **Multiple columns.**
- ❑ **Headers and footers can be multi-line, multi-column and include graphics.**
- ❑ **Styles for emphasis, paragraphs and structures.**
- ❑ **Keyboard short cuts.**
- ❑ **Powerful multi-lingual spell checking – British dictionary supplied, other languages available.**
- ❑ **Hyphenates in all the major European languages.**
- ❑ **Left, right, centre and user definable decimal tabs.**
- ❑ **Insert date and time.**
- ❑ **Undo, redo commands to correct both editing and formatting mistakes.**
- ❑ **Revert to last version saved command.**
- ❑ **Search and replace.**
- ❑ **On line help.**
- ❑ **Multiple documents can be open at once.**
- ❑ **Cut and paste between documents.**
- ❑ **Automatic bulleted lists.**
- ❑ **Automatic table generation.**
- ❑ **Figure structure to add a caption to a picture.**
- ❑ **Documents can be scaled from 10% to 999% of full size for page preview and easy editing.**
- ❑ **Graphics can be in-line or in frames and can be scaled and cropped.**
- ❑ **Change case between Upper, Lower and Initial caps.**
- ❑ **Coloured text.**
- ❑ **Supports RISC OS printer drivers.**
- ❑ **Requires 2Mb Archimedes with outline fonts.**

EasiWriter was developed in association with Acorn Computers.
£150.00 + VAT (£176.25 inc)

ICON TECHNOLOGY LTD
9 JARROM STREET LEICESTER LE2 7DH (0533) 546225
Written and typeset using EasiWriter



WEATHERING THE STORM

THE SUN was definitely shining on the Weather Reporter when it was honoured with the Silver Award in April at the Geographical Association Conference in Manchester.

On presenting the prize the Geographical Association noted that the automatic weather station, developed by the Advisory Unit for Microtechnology in Education together with Hardware Design, was 'an original item of equipment that should make an important contribution to remote sensing and weather interpretation'.

The station looks something like a television aerial, and is relatively easy to install. It works on the BBC B or Master and the Archimedes/A3000 computers, and gives similar readings to Meteorological Office data. However it does not need to be continually plugged into a computer, as the equipment's processor automatically records detailed weather data – wind speed and direction, hours of sunshine and daylight, temperature and rainfall – from the last 60 hours, and daily weather summaries over 60 days.

Whenever you wish to view the weather data you simply attach the serial lead from the Weather Reporter to the computer. The Weather Reporter software will then allow you to display the current weather data on screen, or to download the accumulated information from the processor to a disk. The software can also be used to analyse and display the readings in different ways. The downloaded data can be saved in appropriate formats for use on various machines.

The producers hope to have a new module ready by the end of the year that will measure and record atmospheric pressure and humidity.

The package costs £295, and will be of particular interest to teachers of geography, science, maths and technology at key stages 2, 3 and 4.

For further information contact Diana Freeman at The Advisory Unit for Microtechnology in Education, Endymion Road, Hatfield, Hertfordshire AL10 8AU.


CHECKING OUT THE SKIES WITH THE WEATHER REPORTER

LINE TO THE STARS

Electronic mail, bulletin boards and a database are just some of the facilities available on a new comms system set up by a Norwich school.

Based on an Arc running BB software, Star Net provides an on-line link between all Norfolk schools but, says Paul Welbank of Eaton School's IT department, 'at this stage any school in the country is welcome to log on'. Although contact has been established with French and German schools, Paul would welcome calls from more schools in Europe and beyond.

The IT Department previously ran a viewdata type system before concluding that it was unsuitable for transferring substantial quantities of information. Neither did it have a proper Email function.

According to Paul, 'the system we have now set up is not far behind Telecom Gold in terms of its Email facilities and is capable of handling hundreds of users around the county's schools'. It is also open to the general public.

Files can be up- and downloaded with ease. Primary and secondary schools are currently using the system for information exchange and it is being utilised to transfer text and digitised images for collaborative newspaper projects.

Staff at Eaton are building a database of textual material which pupils can search and add to on-line, and special interest groups can set up their own message, database and file areas.

To access Star Net you need a computer, modem, telephone line and scrolling text terminal software. The number is (0603) 507216. Contact Paul at Eaton School, Eaton Road, Norwich NR4 6PP for details.

PRACTICAL IT

The London borough of Havering has published a comprehensive report on integrating IT into the primary curriculum. It identifies the main areas of IT for schools within a framework comprising creative skills, communication, control and information handling, and outlines strategies for incorporating these into a topic based curriculum.

By such means they explore the 'implications for providing a meaningful IT provision' in a situation where teachers are generally overworked, and there is limited pupil access to the computers.

Contact Gill Lock at the Educational Computer Centre, Tring Gardens, Harold Hill, Romford, Essex RM3 9QX.

Sharon Halpern

NEWS IN BRIEF

● **IN CONJUNCTION** with an archaeological officer from Cornwall County Council, Sherston Software has released Arcventure, an archaeological expedition into Roman times.

Pupils have to locate and identify 'finds' in a dig carried out in a Roman villa. The finds are then reconstructed on the screen in their original state.

Including draw and sprite files of Roman objects and people, it costs £29.95 and runs on the Archimedes/A3000. Contact Bill Bonham at Sherston Software, Swan Barton, Sherston, Malmesbury, Wiltshire SN16 0LH.

● **LITTLE** Red Riding Hood, aimed at five to eight-year- olds, takes the user on a journey with Red to her Grandma's house. The adventure requires number skills, money awareness and logic.

Designed for the Archimedes/A3000 the pack also contains ideas for related activities, and photocopiable masters, and costs £14. Contact Selective Software at 64 Brooke Road, Street, Somerset BA16 0PP.

● **LTS HAS** recently released Ecos and Discover. Ecos provides access to a simulation of the world's ecology and economy and can be used at varying levels in geography and science lessons among others. The standalone version costs £32, the network version is £57.

Discovery is a text disclosure program for use in language lessons, and includes foreign language characters. The standalone version costs £25 and the network version is £20. Both programs run on the A3000/Archimedes. For further information write to LTS at Haydon House, Alcester Road, Studley, Warwickshire B80 7AN.

● **TWENTY ONE** photocopiable activity sheets and a teacher's guide comprise Longman Logotron's Logo Activity Sheets. Providing a range of simple activities it aims to help teachers tackle the Logo attainment targets in the National Curriculum. It costs £12 and is available from Longman Logotron, Dales Brewery, Gwydir Street, Cambridge CB1 2LJ.

● **DIARY DATE:** visit the National Micros for Special Needs exhibition in Oldham from October 1-3 1991. For further details contact Northwest Semerc on 061-627 4469.

Ian Copestake Software

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ABBREVIATIONS

Ace	Ace	Cla	Clares	Min	Minerva
Aco	Acorn	Col	Colton	Oak	Oak
Apr	Apricote	ComT	Computer Tutorial	Pana	Panasonic
Arm	Armadillo	Dat	Data Store	Pand	Pandora
Arn	Arnor	Dig	Digital Services	Pil	David Pilling
Arx	Arxe	Emr	EMR	Ser	Serial Port
Ato	Atomwide	Gra	Graphics Factory	Sil	Silicon Vision
Aut	Autodesk	Hum	Human-Computer	Sim	Simtron
Bai	Baildon Electronics	ICS	Ian Copestake	Spa	Spacetech
Bee	Beebug	Ife	IFEL	Sta	Star
Cal	Calligraph	Ict	Iota	Sup	Superior Software
Can	Canon	Kad	Kador	Tec	TechSoft
CC	ComputerConcepts	Lin	Lingenuity	4ma	4Mation
Cha	Chalksoft	Lon	Longman Logotron	4th	Fourth Dimension
Cir	Circle	MicP	Micro Power	D	Draw format
Cit	Citizen	MicS	Micro Studio	P	Paint format
		Mid	Midnight Graphics	✔	*On special offer!*
		Mit	Mitre		

BBC / MASTER / ELECTRON SOFTWARE

BET Basic Editor and Toolkit		
– rom module	ICS	£19
– rom in cartridge	ICS	£25
Powerfont NTQ	ICS	£13
Spellmaster rom	CC	£52
Wordpower	ICS	£36
– site licence (extra)		£100
– extra rom		£7
– extra manual		VO £7

ARCHIMEDES SOFTWARE

If it's not on the list, please ask for a quote. We will always try to match the best prices.

ABC Basic Compiler	Oak	£77
Accounts	Min	£243
ANSI C Release 3	Aco	£125
Apocalypse	4th	£22
ArcComm 2	Lon	£50
Archway 2	Sim	£78
ArcLight	Ace	£40
ARC-PCB	Sil	£139
– Professional	Sil	£276
Armadeus	Cla	£59
Artisan II	Cla	£44
Artisan Gallery	Cla	£16
Atelier	Min	£67
Autosketch CAD	Aut	£69
Boogie Buggy	4th	£19
Business Supplement	CC	£45
Charts & Graphs	ComT	£17
Chess 3D	MicP	£17
Children's Graphics D P	MicS	£16
Chocks Away	4th	£19
– Extra Missions		£15
Clip Art P	Gra	£19
Clip Art D	Mid	£28
Colour Screen»Mac	Hum	£90
– Arc/Mac Cable		£24
Concept Designer	Lon	£22
Craftshop 1	4ma	£28
Craftshop 2	4ma	£28
Cross-32 Meta-Assembler	Bai	£175
DataVision	Sil	£114
Decorated Alphabet P	MicS	£17
Designer Intro	Tec	£75
Desktop Enhancer	Mit	£26
Desktop Office	Min	£96
Desktop Publisher	Aco	£112
Disc Tree	Mit	£37
DrawBender + Fonts	ICS	£12
– site licence		£50
Drop Ship	4th	£15
DTP Graphics 1 (Mono)	MicS	£15
DTP Graphics 2 (Colour)	MicS	£17
DTP Seeds	4ma	VO £8
Easiword	Min	£31
EQUASOR ✔	CC	£41
E-Type	4th	£15
Euclid 2	Ace	£52
Expression-PS	CC	£19
Film-Maker	Sil	£75
Financial Accountant	Sil	£204
First Words and Pictures	Cha	£19
FLEXIFILE ✔	Min	£101
Flying Start II	Mit	£86
FontFX	Dat	£9
– site licence (total)		£70
Font Pack	Aco	
– Newhall / Starter / Symbol	each	£41
Font Pack 1 (Paladin, Swiss B, SymbolB, Vogue)	Bee	£43
Font Pack	CC	
– Avant Garde / Bookman / Pembroke	each	£29
Fortran 77 Release 2	Aco	£82
Fourier Analysis	Arm	£60
Gammaplot	Min	£52
Gate Array Design/Teaching	Sil	£114
Genesis II	Oak	£114
– education price		£99
GerberPlot	Sil	£92
GraphBox	Min	£61
Hard Disc Companion	Bee	£35
Hearsay	Bee	£51
History Costume P	MicS	£17
Holed Out	4th	£15
Hotlink Presenter	Lin	£43
House of Numbers	Cha	£19
Hyperbook Reader	Lon	£47
Hyperbook Electronic Library (including Reader)	Lon	£109
IMPRESSION 2.1 ✔	CC	£126
– network version		£650
– site licence		£545
– extra hardware key for sites		£15
– extra manual for sites		VO £8
IMPRESSION JUNIOR ✔	CC	£68
– site licence		£435
– extra manual for sites		VO £7
Inertia	4th	£15
Interdictor 2	Cla	£27
Investigator 2	Ser	£23
ISO C Devt System	Bee	£77
Jiglet	4ma	£26
Jigsaw	4ma	£28
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Landmarks	Lon	
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Level 4 File Server	Aco	£189
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Magpie	Lon	£47
Maps and Landscapes 1	Cha	£19
Maps and Landscapes 2	Cha	£19
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Mogul	Ace	£17
Movaword	Cha	£17
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Ovation	Bee	£78
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Pendown	Lon	£50
– Extra Outline Fonts	Lon	£18
Personal Accounts	Apr	£23
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Powerband	4th	£19
Prehistoric Animals P	MicS	£16
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– DataBase	Cir	£25
– WordProc	Cir	£25
Presentation System	Sil	£61
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Presenter II	Lin	£36
Printer Driver, RISC OS	Ace	
– Epson / Star / Citizen colour		£13
Printer Driver, RISC OS	Bee	
– Epson / Star colour		£13
Pro Artisan	Cla	£74
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Puncman 1 and 2	Cha	£17
Puncman 3 and 4	Cha	£17
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Revelation	Lon	£68
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Rhapsody Upgrade	Cla	£13
RiscBASIC Compiler	Sil	£114
RiscForth Compiler	Sil	£114
RISC OS Companion Vol 1	Oak	£49
RISC OS Programmer's Reference Manual	Aco	VO £75
RISC OS Style Guide	Aco	VO £11
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Sigma Sheet	Min	£53
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SolidTools	Sil	£278
Spark	Pil	£5
Speech!	Sup	£16
Spelling - week by week	Cha	£19
Splice	Ace	£25
SQUIRREL ✔	Dig	£102
– Econet or site licence		£475
Studio 24 Plus	Emr	£149
Super-Dump	Sil	£24
Super-Plot	Sil	£32
System Delta Plus II	Min	£54
Timetabler	Min	£575
Timewatch	Mit	£25
Toolkit Plus	Cla	£37
Tools Graphics D	MicS	£24
Touch Type	Iot	£41
Tracer	Mid	£48
Tracker	Ser	£40
Tween	Ace	£25
TWO (Task and Window Organiser)	ICS	£19
– site licence		£60
Utility Disc 1	Dat	£13
Utility Disc 2	Dat	£13
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– Arc/Mac Cable		£24
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World Wildlife P	MicS	£16
1st Word Plus	Aco	£68

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ArcLaser	Cal	£906
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Bubble Jet BJ-300	Can	£399
Bubble Jet BJ-330	Can	£469
KX-P1123	Pana	£199
– 32k ram for KX-P1123 / 4		£20
KX-P1624	Pana	£369
Laser Direct Qume	CC	£856
Laser Direct LBP-4 Card	CC	£309
Laser Direct LBP-8 8 ppm 600 dpi including toner	CC	£1340
LBP-4 4 ppm	Can	£750
LC24-10 32k ram card	Sta	£61
Swift 24 Colour	Cit	£279
Rebuilt Canon Toner cartridge		£45
Archimedes parallel printer cable		£8

FUNCTION KEY STRIP ORGANISER

Arckey	ICS	VO £3
– quantity of 4		VO £10

MEMORY, ARM3 ETC

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‡ Fitting requires expertise

A3000 2Mb †	Ife	£69
A3000 4Mb †	Ife	£243
A310 2Mb ‡	Ife	£215
– as above including fitting		£259
A310 4Mb †	Ife	£POA
– as above including fitting		£POA
8Mb A400/1 / A440 / R140	Ato	£699
ARM3		£400
4-slot 4-layer Backplane	Ife	£57

ideA HARD DISC PRODUCTS — JUNE BARGAINS!

The number at the end of a product name is the capacity in megabytes. An L indicates a 1 inch high disc: two of these may be fitted in the same cradle or external case, sharing the same controller card. An S indicates a 2½ inch wide disc mounted directly on the controller card.

Our 'upgrades' are fully guaranteed and include the ideA controller card, a fan (where needed), and everything else you will require. A backplane is optional with the A310 internal upgrade, but if you do use one it must be a four-layer type.

A300/400/500 series internal upgrade

IDEARCIN20S	23ms	£475
IDEARCIN40	28ms	£269
IDEARCIN40L	25ms	£309
IDEARCIN80L	19ms	£389
IDEARCIN120L	19ms	£549
IDEARCIN200	15ms	£839

A300/400/500 series external upgrade

(May also be fitted to A3000 external expansion slot using a podule case or racking system)

IDEARCEX40	28ms	£395
IDEARCEX40L	25ms	£449
IDEARCEX80L	19ms	£499
IDEARCEX120L	19ms	£699
IDEARCEX200	15ms	£935

A3000 fully internal upgrade

IDEA3IN20	23ms	£375
IDEA3IN40 (ready June?)		£POA
IDEA3IN60 (ready June?)		£POA
Fitting if required		£25

A3000 external upgrade

(External drive using internal expansion slot; can combine with PRES Disc Buffer Board)

IDEA3EX40 etc	
– prices as IDEARCEX40 etc + £10	
Fitting if required	£25

Additional hard discs

IDEA40L	40Mb	25ms	£219
IDEA80L	80Mb	19ms	£309
IDEA120L	120Mb	19ms	£459

A3000 accessories

IC PLINTH **SPECIAL! ☆ £18**

ideA controller cards and accessories

(For use with your own IDE hard discs; we can only accept responsibility for performance with discs we have tested ourselves)

IDEARCIN Archimedes Intern	£110
IDEARCEX Archimedes Extern	£140
IDEA3EX A3000 External	£140
Internal hard disc cradle kit	£15
Fan kit (Standard)	£10
Case with power supply & fan	£125
Fan kit (A3000 Internal)	£15

Recommended for backing up

Beebug Hard Disc Companion £35

Recommended for ease of use

ICS Task & Window Organiser £19

Tel 051-632 1234

Beware of hidden or missing extras, such as fans, when comparing hard disc prices

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PipeDream **PipeDrivers**
Wordpower **Power Fonts**

Please ask for details of our range of Symbol Sets and Typefaces for most printers. For example:

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Black, Caldy, Outline, Pensby, Raby, Shadow, Universal £19

PipeDriver Dot 1

For dot matrix printers with more features than PipeDream knows what to do with – provides access to resident and download fonts, ink colours, variable print size and line spacing etc £10

ODDULES

AnDi	Bai	£49
Oddule Adaptor (needed with your first Oddule unless you have an I²C socket)	Bai	£8

KEYBOARD COVERS

Seal 'n Type (spill-proof)		
– Archimedes	Kad	£14
– A3000	Kad	£14

SCANNERS

Scan-Light A4	CC	£341
– as above + Sheet Feeder		£432
Scan-Light Junior	CC	£175
– A3000 version (internal)		£175
Scan-Light Junior 256	CC	£210
– A3000 version (internal)		£210

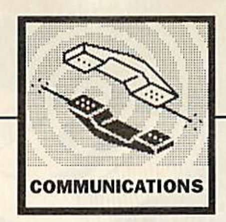
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"TWO is the best thing I've ever bought!"

"DrawBender – an excellent tool. As though I've suddenly come across a new and unexplored area, very refreshing."

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SPEEDY COMMS TAKES OFF

HIGH speed modems are not only becoming more common, but the prices are also rapidly falling, reflecting a more competitive market.

Whilst only a few months ago you had to spend over £1000 for the luxury of 9600bps (v32) the first v32 modem to break the £500 barrier was launched by Dataflex Design in April.

The Rapier modem was initially supplied as a PCcard, but standalone versions should now be available. A pocket version is also being developed. Of course you still get all the standard speeds (v21,v22 and v22bis) but there is no support for 1200/75. Full Hayes command sets and error correction up to MNP level 5 are included. Dataflex also offers v42 error correction and v42bis compression. Prices start at £499.

Bradford based Amber Logic has also unveiled a v32bis modem. Its Mistral range offers the same features as Dataflex's Rapier modems and also offers v29 and v27 half-duplex fax modem standards. MNP5 and v42bis error correction and compression are also supported, although the modems themselves are likely to sell for around £900 for a standalone desktop model. Contact Amber Logic on (0274) 585483.

Racal-Milgo announced a new range of v42bis Maxam modems. The Maxam IV+ costs £399, and for this you get speeds of up to v22bis including v23 (1200/75). For £799 you get its flagship model, the Maxam V+, which offers v32. All models feature MNP error correction and compression, and enhanced Hayes command sets.

Racal-Milgo is already working on a v32bis version to add to its range. According to the company its MNP compression is more efficient than other modems, due to the way compressed data is passed into the data pump. Until recently, MNP was considered to be the ultimate option for modem owners. Now, the availability of v42 means that even MNP5 is looking rather old hat. It is more intelligent than MNP5 and recognises different types of data. This means that a file should never end up longer than the original, whereas when sending a compressed file via MNP5 you can quite easily end up making the file longer than the original.



DOWNLOADING FILES ON PROCRASTINET

So far, one of the few BBC orientated BBs supporting v32 that I have found is Hendon College of Higher Education BB on (0443) 733343 (scrolling,8N1), so if you have access to a high speed modem, why not give it a call?

PROCRASTINET

Procrastinet is a Beeb based bulletin board run by James Coates of Ludlow Sixth Form College. Catering for BBC owners and music enthusiasts, it has large download and special interest areas, including active mail areas. James is trying to organise a Music Network based on Procrastinet. This way numerous BBs can share and pass around music downloads, either for the standard Beeb or for the Music 500/0 range of add-ons.

It is hoped that a 'Net-Mail' protocol will be developed to enable echoing of messages from one BB to another. Interested Sysops (system operators) can contact James, who will send out more details.

The Yorkshire Boys, who have their own section on Procrastinet, are building a name for themselves by writing some excellent PD demos for the Beeb using sampled sound. Quite a few downloads are available which proves that the BBC scene is still very much alive and kicking. Try Procrastinet on (0584) 876012 (viewdata, v21/v23). Users of Procrastinet, and non-modem owners, can obtain a comms related PD magazine, also written and published by James. More details can be found by logging on to Procrastinet and sending a message to James.

DECODED

People often confuse the various v codes, and which modems offer which speeds – the most common ones are listed below for reference.

Paul Vigay

v21 = 300/300bps
v22 = 1200/1200 bps full duplex
v22bis = 2400/2400 full duplex
v23 = 1200/75 bps
v26 = 2400bps, private lines only
v27 = 4800bps for leased circuits
v27bis = 4800bps (equalised) for leased circuits
v27ter = 4800bps for PTSN (public BT lines)
v32 = 9600bps for PTSN
v42 = error correction and compression to give 9600bps

NEWS IN BRIEF

● **NOW FAX** users can turn green with a range of re-cycled fax paper from Kaleidoscope. Kaleidoscope claim its new paper, simply labelled Reclaim, performs perfectly in all makes of thermal paper fax machines at no extra charge.

● **OWN A FAX** – can't afford a separate line? You need a Faxphone 1000 which automatically switches between voice calls and a fax machine connected to the same phone line. Developed by Switch Electronics Ltd it is currently awaiting BABT approval. All necessary leads and a mains adapter are included in the price of £149.50. Switch Electronics can be contacted on (0494) 463532.

● **DO YOU** get lost trying to reply to off-line bulletin board messages? If so, a new program, ReaderS, should be able to help you. Written by Anthony Frost and supplied by Norwich Computer Services as part of its Careware range ReaderS lets you read and compile replies to BB messages simply and within the Risc OS desktop. You can scroll backwards and forwards through the available messages and even re-quote portions of the original text.

This simplifies the whole process of sending and receiving mail via BB and should even make your phone bills smaller if you are a frequent caller.

● **FURTHER** to details provided last month, I regret to say that The Rabbit Run BB has closed due to unforseen circumstances. It will hopefully re-open during the summer or early autumn. Watch this space for news.

● **DO YOU** run a viewdata bulletin board? If so, your board can be added to the latest UK Viewdata Directory.

Send details of your board, including its name and location, Sysop's name, telephone number, hours open, speeds supported etc, to The UK Viewdata Directory, Phantom Comms, 56 Aldham House Lane, Wombwell, Barnsley, South Yorkshire, S73 8RG.

● **PHANTOM BB** is back on-line after a year's absence. Formed in 1986, it is one of the few original UK viewdata boards. Ring it on (0226) 340425 (viewdata 7E1). Keith Burton, the Sysop, is looking for new editors so, if you want to control your own area within the system, drop him an MBX.

Tel: 0276 72046
Fax: 0276 51427



ARCHIMEDES

A3000 PRODUCTS

Monitor stand (A3K1) Probably the best monitor plinth available for the A3000 & the basis of a modular system. £24.95

System housing (A3K2) When you are ready to expand the A3000 this system housing is added, allowing up to 2 floppy drives and a hard drive to be added. £69.50

Expansion card case (A3K3) If you are adding an expansion card ('podule') to an A3000, such asa hard disc card, then you will need this podule case to connect & protect the card. £14.95

Disc buffer (A3K6) If an extra floppy drive/s is to be connected then you will requirea disc buffer. This one supports up to 3 additional drives and incorporates software control for physical to logical drive mapping & 40/80 stepping which could prove essential when using discs in 65Host or PC emulator. A key feature is the built in expansion for further cards to be added internally; also see A3K12. *NB some cheaper products may only provide connection for an additional drive without buffering.* £48.95

20mb hard disc (A3K7) A 20 mb hard disc drive ready to fit in A3K2, including the hard disc card and all cabling. We are not aware of any other hard disc upgrade that is treated as an internal upgrade (consult your Acorn dealer or call PRESfor details). £399.00

40 MB hard disc (A3K14) as A3K7 but twice the capacity. £499.00

3½" additional floppy drive (A3K8) 3½" disc drive & mounting brackets for A3K2. £75

5¼" additional floppy drive (A3K9) 5¼" disc drive & mounting brackets for A3K2 – ideally suited for 65Host or using the PC emulator. £99.95

65Host 1770 DFS & DFS Filer (A3K12) A ROM & disc upgrade forA3K6 provides – 1) a desktop DFS filer that allows DFS filesto be dragged to ADFS viewers or straight into applications as Edit or Pipedream. 2) BBC 1770 DFS for use in 65Host. Automatic Icon and loader which can allow BBC DFS discs to have <SHIFT BREAK> operation. "...effectively turns your A3000 into a model B..." Acorn User Sept '90. £19.95

All prices exc. VAT

"PRES's range of add-ons offers tremendous advantages. The system can grow with your pocket, it offers security and strength but most importantly it offers choice." (AU Feb.90)

The starting point is the monitor plinth, probably (we feel definitely) the best on the market @ only £24.95 (plus VAT) from there . . . System Housing, Hard Disc Upgrade, Additional 3½" Disc Drive, Additional 5¼" Disc Drive, Podule Case, Dedicated A3000 Disc Buffer, 1770 DFS for BBC Emulator & DFS Filer for Desktop, plus more to come! (the last three products can be added independently of the other items)

Contact your local dealer or call PRES direct on 0276 72046 for advice on upgrading your A3000. We have built our reputation on honest dealing on quality products with thousands of satisfied customers.

WE STILL PRODUCE & SUPPLY OUR RANGE OF "8 BIT" PRODUCTS FOR THE electron, **BBC B** AND MASTER. IF YOU WANT TO KNOW MORE ABOUT UPGRADING WITH ACORN COMPATIBLE PRODUCTS... CALL FOR DETAILS.

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THE S.P.A.C.E. KIT . . . FIT A SECOND HARD DISC TO YOUR A400 COMPUTER.

The Missing Link (TML) . . . FAST DATA TRANSMISSION BETWEEN ARCS.

FLOPPY LOCK . . . DISABLES AN ARCHIMEDES DRIVE BY LOCK & KEY.

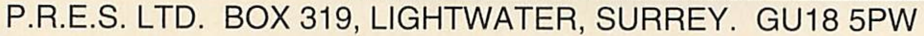
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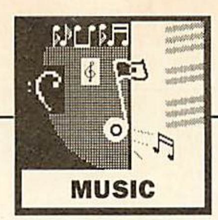








TELEPHONE 0276 72046 FAX 0276 51427



AN AMPLE CREATION

I RECENTLY asked why Ample music composers tended to be a humble and apologetic lot. A new album from Ted Kirk, the man responsible for the Theory of Music programs, shatters this supposition. Good for you, Ted!

His album is divided into two sections – Wishful Thinking and Instrumental – each consisting of four tunes, and comes with four A5 pages of sleeve notes.

Wishful Thinking is an integrated work which began life as a brass quintet. It has been radically re-worked, however, although it is still for five players. The first piece, *Flight From Reality*, is a full five-voice fugue. Very clever, although you don't need to know it's a fugue to enjoy it. *No More Drum Machines* is in a modern vein but contains 7/4 and 9/4 time signatures – and no drum sounds! *Son Of Superman* is Ted's version of a theme (not the theme) for a superman-type movie.

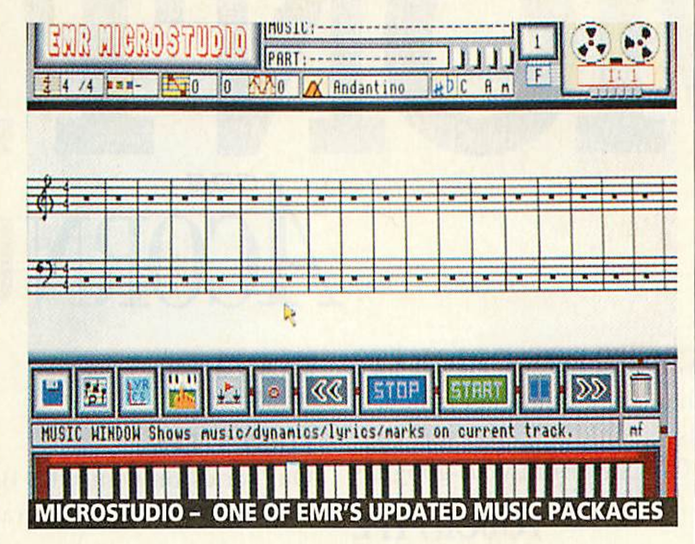
The Instrumentals are even more interesting. *Magic Circle* contains interlocking themes, repeats and variations – tasteful stuff. *Andrea's Tune* is a jazz waltz – nice brush sounds here – with five improvised solos selected at random each time the piece is played. *Black Hammer* is an oriental heavy metal track, containing alternative solos played with a fuzz guitar sound.

Some of the pieces take advantage of the Music 3000 if attached but they will also run on a standard Music 5000 system. The album costs £3.95, and an audio cassette is available at the same price.

Contact Ted Kirk at 33 Humber Crescent, Sutton Leach, St. Helens, Merseyside, WA9 4HD.

PICK OF THE DISCS

This month's dip into the Archimedes *Shareware/Careware* bag of Norwich Computer Services' music discs brings forth *Shareware 36*. It contains a fix for *SoundTracker* modules which cause 'Address exception' and 'Abort on data transfer' errors. You'll know if you need it!



MICROSTUDIO – ONE OF EMR'S UPDATED MUSIC PACKAGES

It also contains a rather neat, albeit very basic, MIDI recorder designed to save data from a Yamaha PSS780 portable keyboard. If you have one of these, you're laughing.

It should let you save voice and song data from portable keyboard-type instruments, saving you a fortune in Ram packs. It will also record MIDI in real-time (that is, from a keyboard as you play it) but it's not in any way a MIDI sequencer.

Careware 4 contains 18 Maestro tunes. Five are rock pieces by Queen, Supertramp and Genesis. The others are a mixture of classics, Mozart, Rossini, Gounod and Hadyn, and traditional pieces such as *Narcissus* and *It's a Long Way To Tipperary*, although some of these are very short.

It's worth remembering that Maestro files will play over MIDI but even if you don't have a MIDI interface, connecting the Archimedes' audio output to your hi-fi will greatly improve the sound. Remember too, that *Maestro* files can be loaded into *Rhapsody* (though not specifically mentioned in the manual) to give the added benefit of *Rhapsody*'s printout and editing features.

Shareware discs cost £3, *and Careware* discs £7. There are also lots of other programs available on these discs. For further details contact NCS at 18 Mile End Road, Norwich, NR4 7QY.

MEMORY SAVER

If you don't have Hybrid's *Ample Toolbox* or the *SideMod* utility, you may be interested in a program on the *Amplinex 19* disc. It's a utility which puts Hybrid System modules such as M.PAD, M.MIX and M.STAFF into sideways Ram.

The program is menu-driven and interrogates your system disc for modules. You can create up to three banks of Rom images. Contact Amplinex at 26 Arbor Lane, Winnersh, Berks, RG11 5JD. If you haven't yet joined, send them a fiver and blank disc (plus p&p) immediately.

THE GENUINE ARTICLE

Hybrid has taken on the final development and distribution of *Music Publisher*, a score-writing program for the BBC micro which offers automatic and authentic layout of music.

Hybrid Technology has become a division of Music Information Technology Ltd to allow them to develop new products in other areas but to ensure that the Hybrid name remains associated with Hybrid products. This coincides with a move to new premises: 88 Butt Lane, Milton, Cambridge, CB4 6DG.

Ian Waugh

NEWS IN BRIEF

● **A FINAL** reminder about The International Music Show which takes place from 10-14 July at the Olympia exhibition centre in London. The 10th and 11th are trade days, the 13th and 14th are public days and the 12th is education day. If you want to see, touch, feel and play all the latest musical instruments – be there! Contact Westland Associates Ltd, 23a Kings Road, London, SW3 4RP. Tel: 071 730 7852.

● **EMR HAS** been busy updating its range of music software. MicroStudio now features the automatic printing of guitar chord parts from any recorded track. This update is free to existing MicroStudio users, and is available as an update for Studio 24 Plus bringing it to V2.0H.

EMR's Music Player will play background music created with MicroStudio or Studio 24 Plus while you run any RISC OS compatible program. It costs £19.95.

EMR has also released a new disc of Studio 24 Plus music files called Symphony 2 containing music by classical composers such as Grieg, Bizet, Beethoven, Mozart and Puccini along with arrangements by groups such as Level 42, the Pet Shop Boys and Phil Collins.

I recently reported that there were plans to integrate Rhapsody files with Genesis although this has been held up by technical difficulties – that's computers for you! EMR is hoping to put EMR music into Genesis, too.

More from EMR Ltd, 14 Mount Close, Wickford, Essex, SS11 8HG. Tel: (0702) 335747.

● **INSPIRATION**, reviewed in March, has rapidly acquired a somewhat tarnished reputation, the early versions being rather unstable. Circumstances forced a release before the program had been thoroughly tested but the boys at Pandora have been beavering away to right the wrongs. The result is version 1.03.

Existing owners should receive a free update. If you haven't, contact your supplier or Pandora on (0273) 725536 between 10am-6pm. More about version 1.03 soon!

● **IF YOU** have any music news, tips or topics that you would like to see covered in this column write to Ian Waugh at BBC Acorn User, Redwood Publishing, 20-26 Brunswick Place, London, N1 6DJ.

NEXT MONTH

BBC ACORN USER

ANYONE FOR CRICKET?

If you go batty trying to keep track of cricket matches, this helpful database should help you sort your Gooches from your googlies

TOUCHTYPE

Sorry we had to hold over the review of this typing tutor from Iota – find out how we rate it next month

COMMS SERIES

In the final part of our series on the fascinating world of communications, we investigate 'handshaking', intelligent modems and file transfer

DESKTOP FOLIO

We review the long awaited interactive publishing package which is already creating great interest in the education market

Watch out for the August issue of BAU – available July 11 1991

PLUS

FIRST STEPS

Our series on using the BBC A3000 continues with advice on typing in programs from our yellow pages

UPGRADING THE A3000

The second of a special two-parter on expanding the memory of your A3000 looks at 8Mb upgrades

ARCCOMM 2

How good is the revised version of Longman Logotron's comms package? Don't miss our review

PIECES OF EIGHT

We delve deeper into the *BAU* archives for more classic programs for the Beeb

REGULARS

- All the latest news and views from the world of Acorn
- Our ★INFO helpful advice and ideas section covering A3000, Archimedes and Beeb
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As market leaders in SCSI drives for the Archimedes and A3000, Oak Solutions has earned an enviable reputation for quality and reliability. Whilst other manufacturers may claim that their drives are 'among the fastest available for the Archimedes', we can truly claim to produce THE fastest drives for the Archimedes with sustained data transfer rates of 1.9 Mbytes per second from disc to Archimedes memory on our larger drives.

The recent introduction of the Worra Winnie range has brought the price of our SCSI hard discs within the price range of users who previously would not have been able to consider adding a hard disc to their system. And yet all drives are top quality units, at least twice as fast as conventional ST506 drives, manufactured and tested under a zero defect quality control regime and with full scope for future expansion.

The 'High Speed' range gives an extra tier of performance and additionally carries a 24 month guarantee, whilst the 'Elite' range offers the ultimate in quality and speed.

Software supplied with the SCSI card allows hard discs to be partitioned into several logical partitions, which may be write protected if required. This feature can prove invaluable in the classroom situation where applications can be stored on a write protected partition – safe from accidental or malicious tinkering – whilst still allowing a read/write partition for data and scrap files. Extra free applications now include 'Euclid', the de facto standard Archimedes 3D software package, as well as 'Disc Tree', 'RISC OS Companion' and 'Worra Battle'

The 16 bit SCSI card gives great scope for future expansion, and can support up to four hard discs, as well as tape streamers, CDROMs, WORM and Magneto Optical drives.



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100Mb	599.00	100Mb	649.00
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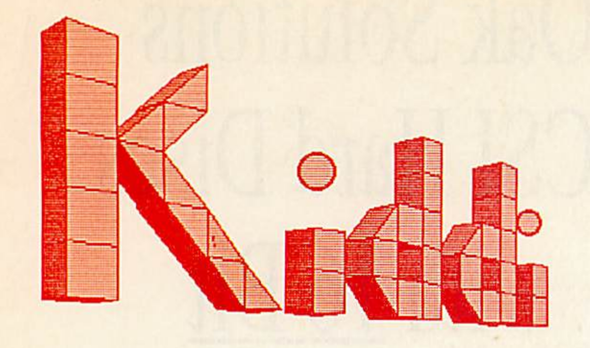
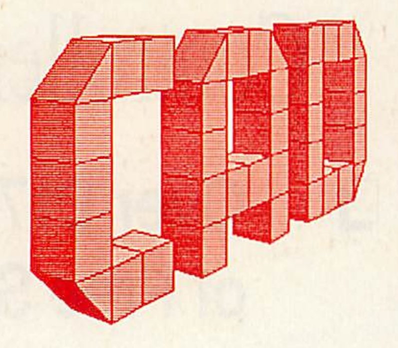
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200Mb	975.00	200Mb	1095.00

Elite Range

External Drives for 300/400 series and A3000			
50Mb	750.00	300Mb	1850.00
100Mb	950.00	680Mb	2500.00
200Mb	1300.00	Mag-Opt	4800.00

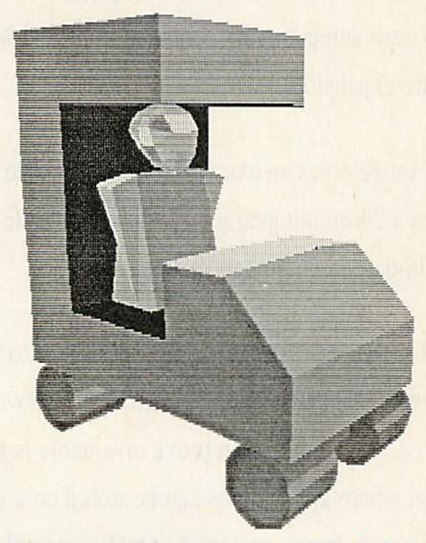
*Drives include 'Euclid', 'Risc OS Companion', 'Disc Tree' backup software and 'Worra Battle' worth over £170

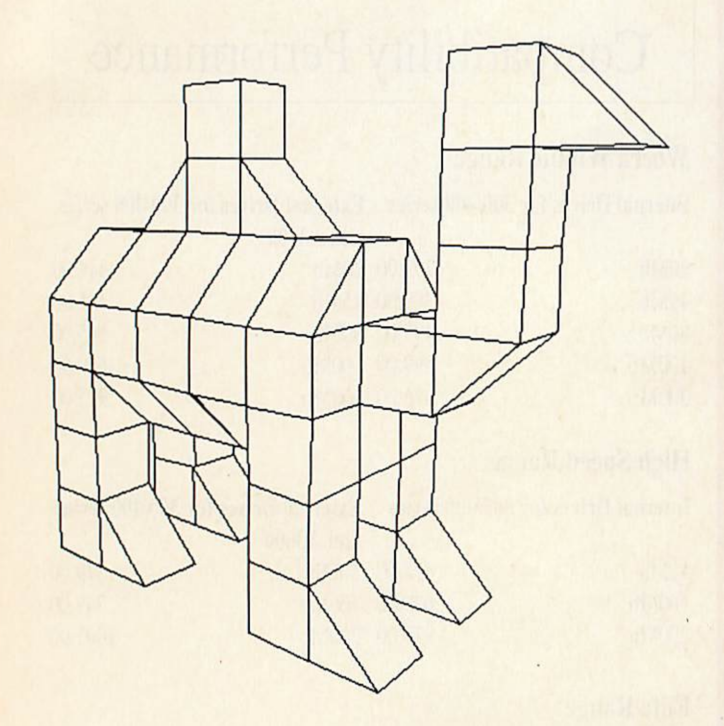
3D Made Easy

KiddiCAD is a revolutionary new 3D CAD system from Oak Solutions, the leaders in CAD on the Archimedes.

Unlike other 3D systems, KiddiCAD has been designed specifically for use by children in the 5 to 14 age range, and completely avoids complex mathematical descriptions of planes and surfaces.



KiddiCAD works by mimicking the use of building bricks - models are simply created by placing bricks on top of one another in a realtime 3D perspective view. It really is childsplay.



256 colours can be used within KiddiCAD, and there is an optional wire frame mode. KiddiCAD can output sprites in any mode for transfer into art packages, Genesis, DTP systems etc., and can output to a wide range of colour or monochrome printers via the standard RISC OS printer drivers.



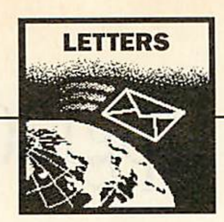




RRP £99 +VAT

Telephone for Education Prices

Oak Solutions Cross Park House Low Green Rawdon Leeds LS19 6HA Tel: 0532 502615 Fax: 0532 506868



HISTORY LESSONS

Your Letters Page in the May issue carried a letter from a history teacher. Mrs J A Rowley-Williams asks for information on databases which might allow her to file and quickly find history questions. Your reply mentions two flat-file databases designed primarily for other purposes, and fails to mention a program which has, in fact, been designed to solve this problem: Clares *Knowledge Organiser*, a development of an earlier program, *ArcTFS*.

As a history teacher myself, I designed these programs to allow fast access to variable length text items – anything from a short question to a historical source of several pages in length, or research notes. *Knowledge Organiser* will put over 100,000 words of text on a floppy, and well over two million on a 20Mb hard disc. If everything related to Henry VIII, was coded HVIII, the typing of this code would retrieve all items, which could then be sorted into strict chronological order for hardcopy or export to DTP.

I know that many packages now exist for the Arc, but I am surprised to find *BAU* forgetful of a powerful, relational freeform database, which it reviewed very favourably in November 1988 as *ArcTFS*, and even more favourably in August 1990 as *Knowledge Organiser*.

Sean O'Conaill
Texellence

GAMES CONVERSION

As a games enthusiast I can't see why some software companies for the Archimedes, like the Fourth Dimension and Eterna, don't convert more of the hit games for the Atari and Amiga to the Archimedes.

I have seen the graphics of games like *Golden Axe* and *Shadow of the Beast* on my friend's Atari and they could easily be achieved on the Archimedes. Some big software companies have converted games like *Mad Professor Mariarti*, *Pacmania* and *Twinworld* to Archimedes format so why don't they bring out the rest of the brilliant Atari and Amiga games for the Arc, and maybe even a couple of enhancements!



WILL WE SEE MORE PORTS IN THE FUTURE?

Also, I'm sure that Arc owners would like to see some old Beeb classics like *Citadel* and *Palace of Magic* converted and upgraded.

William Fletcher
Welywn

Recently the Acorn games market has seen a small flood of companies, producing games for the Archimedes that you would normally associate with the higher volume Amiga and Atari market.

Virgin released *Wonderland*, Domark brought out *Mig 29 Fulcrum* and soon we should see *Lemmings* from Psygnosis. French company Eterna is also supporting the Arc, transferring its coin-op games to standard Archimedes format.

Keep an eye on the *BAU* games page for further interesting developments, you may be pleasantly surprised by what you read.

YELLOW FEVER

Further to the letter from B Hunt in the June issue I agree almost entirely with much of the letter, especially how typing in listings can help develop programming skills.

Over the years, as I have progressed through the BBC model B, Master 128 and now the Archimedes, I would guess that at least 50 percent of my knowledge of BBC Basic is due to the typing in of such listings. However what I do disagree with is the subject of checksums.

I have been an avid reader of *BBC Acorn User* since issue one. As far as I can remember, you pioneered the inclusion of checksums in your magazine for a few issues in the early days. For some unknown reason these were stopped! Please, oh please, bring them back, especially for the longer listings, they really are worth their weight in gold when it comes to debugging.

Finally, where is listing 3 for the *PicList* utility, published in the May issue?

M A Bodley
Lincoln

Mr Hunt's letter suggested checksums make typing more of a chore and we, here at *BAU*, tend to agree. Checksums do make typing in more of a 'chore' ie, a 'mechanical' process of ensuring the checksums match. We think readers find they learn more from correcting programs using their own brain power.

We still think the best way of debugging a program is to run it, see where the mistake occurs and then search for the procedure that contains the possible cause of the error.

Of course, if anybody has any different ideas then please let us know.

Listing 3 for *PicList*, which was left out of the yellow pages by mistake, is as follows:

```
Set Pic-List$Dir <Obey$Dir>
IconSprites <PicList$Dir>.!Sprites
RMEnsure ColourTrans 0
RMLoad System:modules.Colours
WimpSlot -min 96K -max 96K
<Obey$Dir>.!RunImage
```

It must be entered into an Obey file created by *Edit* and saved as !Run in the !Piclist directory. An Obey file called !Boot should also be created, containing the following line:

```
Iconsprites <Obey$Dir>.!Sprites.
```

DRIVERS VIEW

Having used your printer driver generator for some time, I discovered how to overcome the problem of the first embedded code being used as the second if ESCAPE is pressed during printing.

The solution is simple but not obvious, it only needs each code to be duplicated.

To do this you enter the code to turn the effect on in both the on and off position of the table. Then use the next letter to switch the effect off by entering the off code in both positions. This way, the embedded code implicitly turns on or off the printing effect when it is encountered.

Also, if your printer does not support ESC 64 RESET, all the off codes can be included at the beginning of the text, giving the same effect.

You may also include another code if and when less than three parameters are needed. Two useful examples of this are:

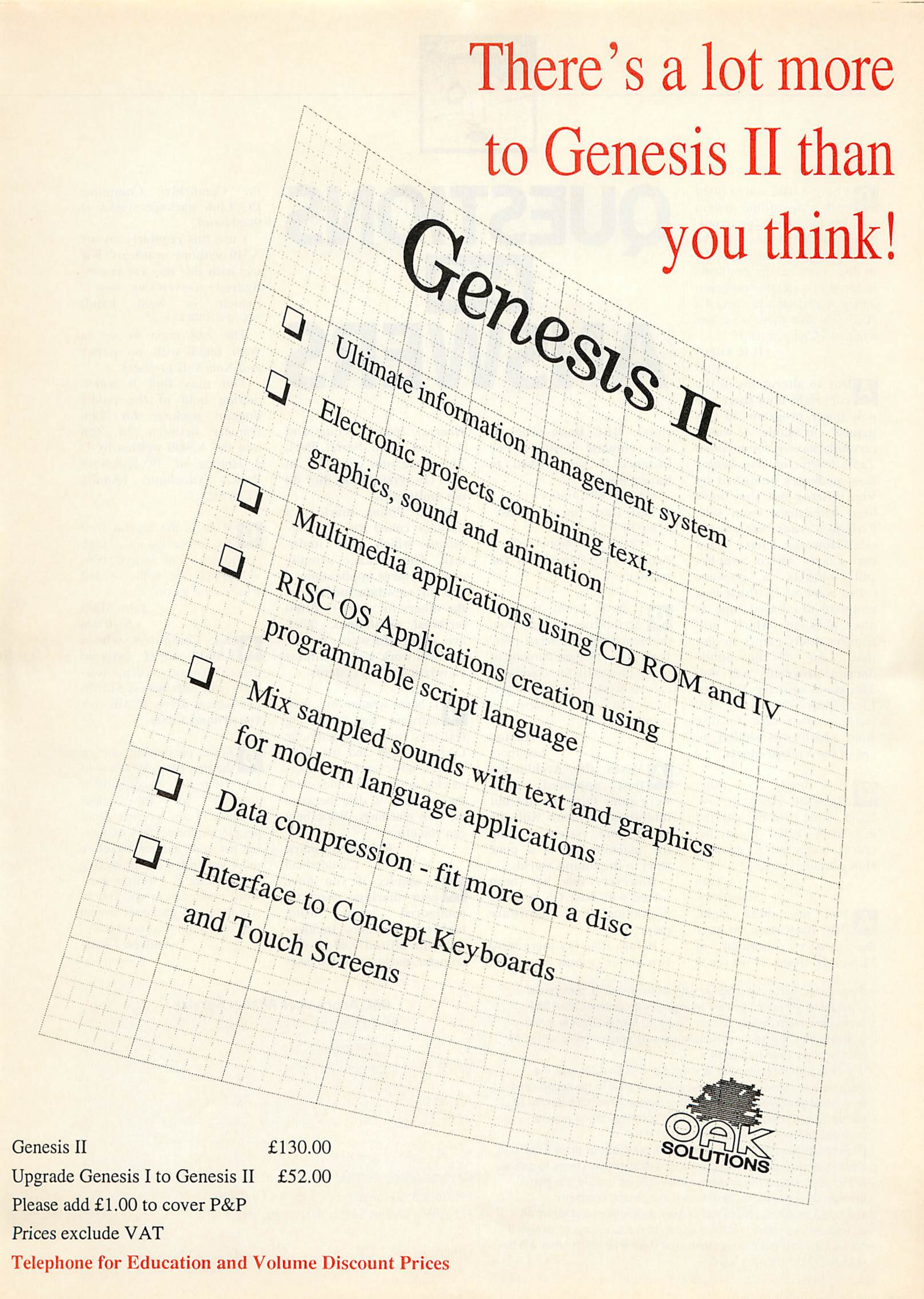
24,27,64 – Clear printer buffer and reset

18,27,84 – Condensed off, Super/Subscript off

William Woodhall
Yeovil

STAR LETTER

The Letters Page is one of the most important pages in the magazine. It is the page where you can let us, and all our readers, know what you think about the magazine, your computer, software, or anything else you think readers would be interested in. To encourage you to write to us, we will be offering £15 for the best letter we receive each month. Send your letters to The Editor, BBC Acorn User, 20-26 Brunswick Place, London N1 6DJ.


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QUESTIONS AND ANSWERS

Q I have a BBC micro fitted with a disc filing system and am searching for a program to assist me in the transfer of programs from tape to disc. I am having problems in locating a suitable program, although a friend who owned a BBC said that there were lots available. Can you help?

H R Angus
Ashford

A **Due to alterations in the copyright laws there are now fewer programs of this nature available. I would certainly have recommended *Tape to Disc* or *The Replay* Rom packages published by Vine Micros but they have been withdrawn from sale. Perhaps a reader has one for sale? However, I have heard that Clares Micro Supplies still markets a package called *Replica 3*, which is a powerful disc-based tape to disc package which will transfer many games to disc that some of the public domain programs will not. You could also try Watford Electronics which may still have its own tape to disc Rom which was similar to one of the Vine products.**

Q I'm used to using MicroSoft Basic, or GW Basic on the IBM PC and find that with BBC Basic the LPRINT command is missing. How can it be emulated?

A Tate
Smethwick

A **You are quite right, BBC Basic does not have the LPRINT command of Microsoft Basic. However a simple BBC Basic program can emulate LPRINT. For instance if you wished to have a line like**

```
LPRINT "BBC Acorn User"
```

in BBC Basic you should use

```
10 VDU 2
20 PRINT "BBC Acorn User"
```

(where VDU 2 turns on the printer).

Q I have heard that the Archimedes suffers from problems with the serial port? Is this true, as I am thinking of using an A310 for communications work? If everything is okay can you recommend a comms package?

T H Huxton
Liverpool

A **When the Archimedes first appeared, there were some fairly obsure but inhibiting problems with the serial port system, getting the machine off to a poor start in the comms world.**

However, this has been solved with Risc OS, and the upgrading of the hardware chip.

Before Risc OS there were two major comms programs, *Hearsay* from Beebug and *ArcTerm* from Serial Port. These are now available in Risc OS versions but they do not multi-task.

David Pilling markets a package called *Risc OS Terminals* which does multi-task. The package actually contains three applications – one for viewdata mode, and the others for Ansi (VT100) terminal emulations. They are straightforward to use and will work well with most viewdata and BB systems.

Q I have written my own software for transfering text files from the Cambridge Computer Z88 and my BBC A3000, however I am experiencing some difficulties with the transfer of data between the two machines. What help can you offer?

Robert Newmark
Sunderland

A **I wonder if you have your machine correctly configured when using higher baud rates. Incidentally the official Z88 to Arc transfer package which uses the Cambridge Computer PC Link package works at 9600 baud.**

I use this regularly on my A310 without problems. For use with this the Arc is configured *CONFIGURE baud 7 (which is 9600 baud) *CONFIGURE Data 4.

The Z88 must be set to 9600 baud with no parity and Xon/Xoff protocol.

You may find it worth getting hold of the public domain package for data transfer between the Z88 and the A3000 written by D J Holden of 39 Knighton Park, Sydenham, London SE26 5RN.

Q What is the biggest hard disc drive that an A3000/ Archimedes can access? Who will supply me with one and what would it cost?

John Miles
Swindon

A **Oak Computers sells a 640Mb SCSI external drive. However Acorn's software will only access 512Mb per logical drive. It will cost you around £4000.**

Q Since purchasing one of the first BBC A3000s sold I've been very busy writing software for this super machine. I am worried about people exploring and exploiting my code and am therefore most interested in protecting my software by a form of password protection or encryption. Are there any packages around that you could recommend?

Andrew Lootle
Kingswood

If you have a particular problem with an Acorn micro, commercial software or a program you are trying to write yourself, then BBC Acorn User might be able to help. The BAU Post A Problem service guarantees to give you a personal answer to your problem within 10 working days – and for just £4.
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A **I think you will find *Encode*, a program published by Beebug for the Archimedes and BBC A3000 to be what you need.**

The program is published on *Risc User* Special Disc Volume 3.

Q I have had an Acorn Electron for many years and I now find that the power supply unit has failed. I'm experiencing some difficulty in obtaining a replacement main power adaptor for it. What do you recommend?

Robert Burnie
Southgate

A **As you may know Acorn no longer manufactures the Electron, although I'm sure it holds some parts, or could advise you of a suitable source. Try its Customer Services Department on (0223) 245200.**

You may be able to get your mains power adaptor repaired. Clarke Computer Services, which specialises in repairing BBC computers for the educational market, can be contacted at Abacus Buiness Centre, Manor Road, Ealing W13 0AS, Tel: 081-566 7292. You could also consider the purchase of a separate power supply unit of the correct voltage and amp to connect to your Electron. Maplins may be a good source for such a device.

Q I am about to write some database software for my BBC Master Compact that will enable me to computerise my telephone directory.

However, I realise that I need some help in writing routines to add and delete records from the file. Can you recommend any books that will offer me both basic advice, and more specialist knowledge?

J F Thorton
Lampeter

A **For basic information on data structures and data handling in BBC Basic I recommend *BASIC Programming on the BBC Microcomputer* by Neil and Pat Cryer, published by Prentice Hall.**

Two more specialist books on file handling are *File Handling on the BBC Microcomputer* by Brian J Townsend, published by MacMillan, and *Filing System and Databasees for the BBC Micro* by A P Stephenson and D J Stephenson, published by Collins. Beebug has also recently published a book called *File Handling for all – on the BBC Micro and Acorn Archimedes* by David Spencer and Mike Williams.

Q I am confused over the function of the Q parameter used with the *SRLOAD command with my Master 128. Can you explain what it is for and what it does?

Dr R Giaccio
Australia

A **The optional Q parameter used in *SRLOAD speeds up loading by using OSFILE rather than OSBGET. As it uses I/O main memory as a buffer, from OSHWM onwards, it will corrupt data in memory unless you have a co-processor.**

Q We have a number of BBC Master 128s at our school, and a parent recently donated a Tandy DMP 200 printer. We are delighted of course, but are having problems getting it to work properly. Could it be that it is incompatible with the BBC computer?

R Howitt
Windsor

A **The Tandy DMP 200 printer is Epson compatible and should work with a BBC computer without any problems.**

It should work with a standard BBC Centronics ribbon cable attached from the printer port to the printer itself. You may have to alter some settings inside your DMP 200 to enable it to be used with its parallel interface. These are called DIP or DIL switches, and your printer manual should help you with this alteration.

You can also use the printer with the RS-423 port, also known as the serial port on the BBC model B.

If you continue to have problems with your printer, you can contact Tandy direct on (0922) 710000.

ACORN CUSTOMER HOTLINE

Unfortunately, there were a few errors in last month's Acorn Customer Hotline column which I would now like to correct.

Contrary to last month's column, the Risc OS Extras disc is not available from Acorn Direct, however, it can be obtained from your local Acorn authorised dealer. The correct version number of NetFS should be 5.53, and Econet, which was omitted altogether, is 5.48.

Last month's article also documented the version number of 65Host as being 1.40, but the correct version number for the application is actually 1.60 and the module's version number should be 1.19.

To find out what version number of the module you have, run the 65Host application, and exit the emulator by typing *QUIT, followed by RETURN. Press the function key F12 to access the command line, whereby the star prompt(*) will appear, then type *HELP MODULES followed by RETURN. Press RETURN at the next star prompt.

● We have had a number of enquiries regarding the use of the Archimedes/A3000 range of computers with Open University courses. Acorn has spent some time working together with the Open University, and the PC Emulator is now approved for use on various courses.

Any users wishing to use the PC Emulator for a particular course, should contact the Open University in Milton Keynes.

● The printer drivers for the First Word Plus wordprocessor can be found on the First Word Plus utilities disc in the directory '1wp_print.config'.

However, on the various bulletin boards mentioned in the Comms column each month, there are now a number of First Word Plus printer drivers which users have modified for their own printer types if different from the printer drivers supplied with First Word Plus.

If you wish to contact these bulletin boards you will of course need a modem and a serial upgrade for the BBC A3000, plus suitable driving software.

● For many years now Acorn has been dedicated to the area of computers in Special Needs. With the launch of the Acorn Special Access system (see the News pages) Acorn has included a disc containing a number of utilities, some of which are public domain and some of which have been specially written by Acorn.

The utilities include different screen modes to provide larger text sizes. And there's Flasher which makes the caret (the cursor used when entering text) flash so that it can be seen more easily, and BigPointer which provides a large pointer. There are also a number of other functions supplied which help to meet the requirements of a wide range of users with special needs.

● In between the BBC model B and the BBC Master 128 Acorn produced the BBC model B+.

Here in the Customer Services department we have a large number of enquiries from users who think that they have a model B when they actually have a model B+. The B+ is recognisable in that, when switched on, it behaves differently to the Beeb. When switched on, the B+ displays the following message on screen: Acorn OS 64K (or 128K).

Furthermore, by typing *FX0 followed by RETURN the operating system version number displayed on the B+ will be 2.00.

If your B+ only has 64K fitted it is possible to add a further 64K of sideways Ram to the system by using the Acorn upgrade product ANB27. This costs £34.75 (ex VAT), a price which includes expert fitting by your local authorised Acorn dealer.

● If you need to contact Acorn for any reason please do not phone us if at all possible. We would prefer people to write, and the address is Acorn Computers Limited, Fulbourn Road, Cherry Hinton, Cambridge CB1 4JN.

I would be interested to hear any ideas as to what topics you would like to see covered in the Acorn Customer Hotline column. Please note that the ideas can only cover Acorn software or hardware products, as I am not permitted to cover third party hardware or software.

Please send any ideas to me at the above address.

Peter Dunn

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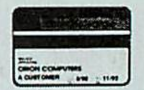
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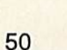
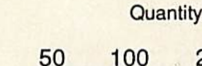
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Epson LX80/86	£3.75
Epson FX80,MX80,LX800	£4.50
Epson LQ400,550 Fabric	£5.25
Epson MX100,FX1000,FX1050	£5.75
Epson EX800/1000 Black	£7.25
HP Paintjet Black	£21.00
HP Paintjet Colour	£26.00
HP Deskjet + (Permanent Ink)	£13.20
Panasonic KXP145	£7.50
Panasonic KXP140	£9.35
Panasonic KXP115	£7.50
Star LC10	£3.80
Star LC10 4 Colour	£5.75
Star LC200 Black	£5.00
Star LC200 Colour	£9.75
Star LC24/10 / LC24 200 Black	£4.75
Star LC24 200 Colour	£11.50
Canon LBP4 Toner Cartridge	£59.00
Canon LBP8 Toner Cartridge	£69.00
Qume Crystal Print Toner Set	£67.00
Qume Crystal Print Drum Set	£89.00

Software

DTP

Impression II (CC)		£145.00
Impression Junior (CC)		£74.00
Tempest D.T.P. (Clares)		£99.00
Ovation D.T.P. (Beebug)		£99.00
Desktop Folio (ESM)	NEW	£79.00

Spreadsheets

Sigmasheet (Minerva)	£39.95
Schema (Clares)	£99.00

WordProcessors

1st Word Plus Release 2 (Acorn)	£69.95
EaslWord (Minerva)	£31.95
Protext 5.0 (Arnor)	£119.00

Integrated Packages

Pipedream 3 (Colton)	£119.00
Desk Top Office (Minerva)	£99.00

Databases

Datavision (Silicon Vision)	£127.45
Flexifile (Minerva)	£119.00
Multistore (Minerva)	£199.00
Genesis II (Oak Solutions)	£119.00
Knowledge Organiser (Clares)	£42.00

Accounting Software

Financial Accountant (S. Vision)	£233.75
Home Accounts (Minerva)	£39.45
Business Accounts (Minerva)	£325.00
Office Tools (S. Vision)	£318.75
Shareholder (S. Vision)	£165.75
MicroTrader Accounts	£199.00
MicroTrader Stock Control	£75.00

Languages

ANSI C Release 3 (Acorn)	£125.00
RiscForth (S. Vision)	£127.45

Music

Armadeus (Clares)	£61.00
Rhapsody (Clares)	£39.95
Tracker (Serial Port)	£38.95

Utilities

Arc DFS (Dabs Press)	£22.95
Dot Matrix Colour Printer Driver (Ace)	£13.00

Education

Maths Pack (HS Software)	£11.95
Reading Pack (HS Software)	£15.75
Bumper Pack II (HS Software)	£15.75

Graphics Manipulation

Poster + Fonts (4Mation)	£79.00
Render Bender (Clares)	£58.00
Solids Render (S. Vision)	£127.45

CAD

ARC-PCB (S. Vision)	£165.75
PCB Professional (S. Vision)	£318.75
SolidCAD (S. Vision)	£127.45

Games

Arcpinball (Shibumi)		£18.00
ARCticulate (4th Dim.)	NEW	£18.00
Ballarena (Systeme)		£14.75
Blowpipe (Eclipse)		£14.45
Boogie Buggy (4th Dim.)	NEW	£18.00
Chess (Micropower)	NEW	£14.45
Chocks Away Version II (4th Dim.)		£18.00
Chocks Away Extra Missions	NEW	£14.45
Chocks Away Compendium	NEW	£28.00
Drop Ship (4th Dim.)		£14.45
E - Type (4th Dim.)		£14.45
E - Type 100 Miles (4th Dim.)		£12.75
E - Type Designer (4th Dim.)		£12.75
Gumshoes (4th Dim.)	NEW	£18.00
Holed Out (4th Dim.)		£14.45
Holed Out Designer (4th Dim.)		£14.45
Holed Out Vol. 1 or 2 (4th Dim.)		£12.75
Hostages (Superior)		£14.45
Iron Lord (Cygnus)		£14.45
Inertia (4th Dim.)		£14.45
Interdictor 2 (Clares)		£26.00
Mad Professor Mariarti (Krisalis)		£14.45
Manchester Utd. (Krisalis)		£19.50
Master Break (Superior)		£14.45
Microdrive 3D USA Courses		£14.75
Mig-29 Fulcrum (Domark)	NEW	£29.00
Minipack 5 (C.I.S.)		£23.95
Nevryon (4th Dim.)		£14.45
No Excuses (Arcana)	NEW	£14.45
The Olympics (4th Dim.)		£14.45
Pipemania (Empire)		£16.45
Powerband V. II (4th Dim.)		£18.00
The Real McCoy (4th Dim.)		£21.50
The Real McCoy 2 (4th Dim.)	NEW	£21.50
Turtles Tour the World (E. Crayon)		£14.45
Twin World (Cygnus)		£14.45
Speech (Superior)	NEW	£14.45
Superior Golf (Superior)		£14.45
Square Route (Computereyes)		£14.45
Wimp Game (4th Dim.)		£14.45
World Champ. Boxing Man. (Krisalis)		£19.50
WorldScape (Eclipse)		£14.45

Graphics - Art

Artisan II (Clares)		£49.95
Pro Artisan (Clares)		£79.00
Atelier (Minerva)		£79.00
The Clipart Collection Vol. 1	NEW	£19.95

Graphics - Presentation

Hotlink Presenter(Lingenuity)	£46.95
Graphbox (Minerva)	£62.45

Misc

PC-Emulator (Acorn)		£94.00
Investigator II (Serial Port)	NEW	£22.95

Instant Finance available up to £1000

Puchases can be made at our premises and instant credit is available with Lombard Tricity Finance Ltd (Subject to Status). Finance is over 36 months on any purchase over £100 (APR 36.8%*).

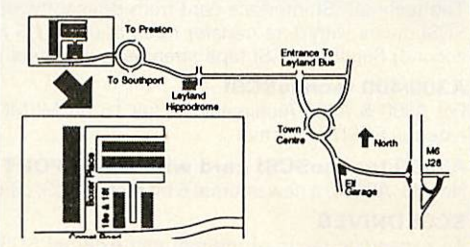
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* Subject to change without notice

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Watford Electronics

(A member of the Jessa group of Companies – Established 1972)



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Acorn

The sign of Quality

Shop Hours: 9am to 6pm (Mon.-Sat.) Thursday 9am to 8pm. FREE customer car park.
All prices exclusive of VAT; subject to change without notice & available on request.

The choice of Experience

Archimedes micro

System	Basic	Mono	Colour	Multiscan
410/1	£1099	£1159	£1278	£1448
420/1	£1299	£1359	£1478	£1648
440/1	£1699	£1759	£1878	£2048
540/1	£2995	£3065	£3178	

Archimedes A3000

12 MONTHS FREE MAINTENANCE ON SITE

- A3000 Microcomputer £599
- A3000 + Learning Curve pack £699
- 3.5" External Drive £99
- Monitor Stand £16
- External Podule Case £13
- Serial Upgrade £17
- Technical Manual £60
- SCSI Card £149
- Dust Cover Micro only £5
- Dust Cover for Micro + Monitor £9
- User port/MIDI upgrade £45
- UHF TV Modulator £30

Unbeatable Sale Offers on Archimedes Micro

When you purchase an Archimedes Micro from Watford, look what you get FREE with it

Micro	Free Offer
A410/1	Upgraded to 2MB RAM & a 20MB Hard Disc, (A420)
A420/1	Upgraded to 4MB RAM 40MB Hard Disc (A440), MK II Learning Curve pack and Acorn DTP pack
A440/1	High Res 14" Multiscan Colour Monitor
540/1	High Res Multiscan Monitor & Panasonic KX-P1180 Printer
A3000	Upgraded to 2 Megabyte of RAM & a A3000 Monitor plinth.

+ 12 months FREE On-Site Maintenance
(P.S. Instead of the above Hardware upgrades on A410/1 & A420/1, we will fit the 30MHz Turbo Board if required. Please specify your requirement when ordering.)

Archi Accessories

- NEW Multitasking RISC OS £29
- 3.5" 800K 2nd Floppy Drive (305/310) £118
- 5.25" 800K external Floppy Drive £85
- I/O Podule (with Analogue port, User port, & 1MHz bus) £76
- MIDI add-on to I/O Podule £29
- MIDI Expansion Card £65
- Sound Sampler Mono (Armadillo) £129
- Sound Sampler Stereo /Midi (Armadillo) £186
- Chromalock Podule (Wild Vision) £275
- Econet Network Board £44
- Archimedes IEEE Interface Adaptor £269
- Dual RS232 Podule £195
- 16 bit parallel I/O Card £195
- Archi replacement mouse – New design £32
- PC Emulator NEW Faster Version £62
- Software Developers Toolbox £149
- Floating Point Unit £455
- SCSI Adaptor Expansion Card £162
- Keyboard Extension Lead £6
- 2 Podule Backplane £25
- 4 Podule Backplane £38
- Fan for above backplanes £8
- Risc Os Extras Software Disc £5
- Smoked Perspex Low profile Keyboard Cover £8
- Ethernet Card £220

0% Finance Now Available

On Acorn Archimedes A3000 and A420/1 with learning curve packs. (Please telephone for details)

8 Meg RAM Upgrades

- **R810** – A410/1 upgraded to 8MB £740
- **R820** – A420/1 upgraded to 8MB £689
- **R840** – A440/1 upgraded to 8MB £579
- **R814** – R140 upgraded to 8MB £579

Turbo Charge Your Archimedes

Increase the speed of your Archimedes by a factor of THREE to SIX times (depending on the software you are running), with Watford's ARM3 Upgrades.

- **ARM-3** 20MHz Upgrade Board £325
- **ARM-3** 30MHz Upgrade Board £375
- **MEMC** 1A Upgrade £42

(ARM 3 price includes a FREE Chip extraction tool)
(Special Offer – If purchased together with an Archimedes Micro, then not only will we fit the card Free of Charge but we will also reduce the price by £40 i.e. You pay only £285 for ARM3 20MHZ & £335 for ARM3-30MHz)

Archimedes RAM Upgrade

All our memory upgrades are simple to fit. No soldering required. Fitting instructions supplied.

- **R302**-A3000 – to 2MB RAM Upgrade £52
- **R304**-A3000 – to 4MB RAM Upgrade £169
- **R311**-A305 – to 1MB RAM Upgrade £50
- **R312**-A305/310 – to 2MB RAM Upgrade £235
- **R314**-A305/310 – to 4MB RAM Upgrade £425
- **R412**-A410/1 – to 2MB RAM Upgrade £39
- **R413**-A420/1 – to 4MB RAM Upgrade £75
- **R414**-A410/1 – to 4MB RAM Upgrade £105

Archimedes Hard Disc

Watford's ST506 Hard disc drives for A310 & A410 series fit internally into the space provided. The 'simple to follow' fitting instructions supplied makes drive fitting very easy. All disc drives are auto parking. 40Meg & 53Meg drives are fast 24mS type, while 20MHz are 28mS.
P.S. A310 upgrades require a backplane and a fan.

- **3HDP** – Hard Disc Podule only £135
- **3HD20** – 20Meg H' Disc + Podule for 310 £289
- **3HD40** – 40Meg H' Disc + Podule for 310 £389
- **3HD50** – 53Meg H' Disc + Podule for 310 £474
- **4HD20** – 20Meg Hard Disc for 410 £165
- **4HD40** – 40Meg Hard Disc for 410 £245
- **4HD50** – 53Meg Hard Disc for 410 £335
- A3000 20Meg Hard Disc + Podule £345
- A3000 40Meg Hard Disc + Podule £459

Convert your Archi 410 to a 420 or 440 with Watford's unique Upgrade Kits

UP10	to 2MB RAM + 20MB Hard Disc	£210
UP15	to 2MB RAM + 40MB Hard Disc	£315
UP20	to 4MB RAM + 20MB Hard Disc	£265
UP30	to 4MB RAM + 40MB Hard Disc	£345
UP40	to 4MB RAM + 53MB Hard Disc	£475

Silicon Vision

Gerber Plot	£95	Super Dump	£22
Solid CAD	£120	Solids Render	£120
Super Plot	£30	Solid Tools	£279
Arc PCB Professional			£275
Realtime Solids Modeller			£138

STAFF VACANCIES

Watford Electronics is the leading supplier in the Acorn computer field and has established itself in the PC compatible market with its Aries PC computers. In its eighteen year history, Watford has always kept itself at the forefront of the new technology. Due to our latest expansion, we require staff to man our BBC/Archimedes and PC Technical Departments. Applicants will be required to be familiar with BBC/Archimedes hardware and software, and PC staff will need to be familiar with PC computer hardware. Good rates of pay, excellent prospects. Subsidised company accommodation is available to single persons if required. Telephone Keith Archer or Shiraz Jessa for interview, or write to us enclosing your CV.

Archi Mouse Port Splitter

Continuous plugging and unplugging of the mouse is not only inconvenient but can also damage your micro. Our handy little Archi mouse port splitter unit eliminates this risk by allowing you to connect a mouse and a joystick or a tracer ball simultaneously to your Archimedes micro. The miniature slide switch on the box enables you to select the socket to be used.

£15

Graphics, Art, Design & Games

GRAPHICS

Atelier	£65
Artisan II	£47
Artisan Gallery	£16
Autosketch II	£68
Craftshop 1 & 2	£28
Euclid 2	£52
Graph Box	£59
HotLink Presenter	£42
Kermit	£46
Mogul	£19
Poster	£79
Pro Artisan	£72
Render Bender	£58
Snippet	£26
Tween	£25

GAMES

ArcPinball	£18
Apocalypse	£21
Arcade 3 Compil.	£12
Arcade Soccer	£15
Arc Pinball	£18
Arc Trivia	£18
Avon	£16
Ballerina	£16
Blowpipe	£16
Break 147	£20
Bug Hunter	£14
Caverns	£14
Chess 3D	£17
Chocks Away	£18
Conqueror	£18
Cops	£14
Corruption	£18
Crisis	£23
Drop Ship	£15
Enthar Seven	£22
E-Type	£17
E-Type Designer	£15
E-Type Extra 100 miles	£15
Family Favourites	£15
Fireball 2	£19
Holed Out Designer	£15
Holed Out Golf	£15
Hostages	£15
Ibix the Viking	£14
Inertia	£15
Inter Dictor 2	£26
Iron Lord	£15
Jet Fighter	£10
Jiglet	£25
Jigsaw	£27
Magpie	£39
Man at Arms	£16
MahJong Patience	£15
Manchester United	£19
Nevryon	£14
Olympics	£15
Pipe Mania	£19
Pirate	£16
Power Band	£20
Puncman 1 & 2	£16
Puncman 3 & 4	£16
Pysanki	£15
Real McCoy	£22
Real McCoy 2	£23
Redshift	£14
Return to Doom	£16
Revelation	£54
Repton 3	£15
Rotor	£20
Splice	£25
Sporting Triangles	£24
Star Trader	£14
Superior Golf	£15
Talisman	£12
The Pawn	£19
Thundermonk	£11
Timewatch	£24
Trivial Pursuit	£23
Twin World	£17
U.I.M.	£23
White Magic	£15
White Magic 2	£15
Wimp Game	£15
Worldscape	£16

Miscellaneous

Ancestry	£59
Arccomm Pack	£24
Arcterm 7	£69
Armadeus Sound	£60
BBC DFS Reader	£6
Equasor	£40
FlexiFile	£98
Genesis	£65
Genesis 2	£125
Hearsay Comms Pack	£50
Investigator 2	£22
JX Archi Colour Printer Driver for Citizen & Star	£15
Numerator	£66
Presenter 2	£35
Presenter Story	£145
Revelation	£62
Rhapsody in Blue	£39
Speech!	£16
Toolkit (Clares)	£42
Touchtype	£40
Tracer	£46

LANGUAGES (Archimedes)

ISO-PASCAL; FORTRAN 77			£77 each
Assembler; LISP; Prolog X			£149 each
ANSI C Rel. 3	£125	BASIC Compiler	£77
Cambridge Pascal	£60	Logotron Logo	£55
Macro Assembler	£40	Risc Basic	£120
Robo Logo	£69	Risc FORTH	£110

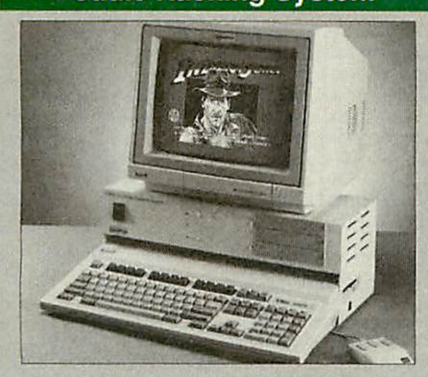
Minerva's Archimedes Software

Home Accounts*	£36	Sales Ledger*	£53
Stock Manager*	£53	Purchase Ledger*	£53
Nominal Ledger*	£53		
Ancestry	£59	Reporter	£29
System Delta+	£55	Mailshot*	£29
System Delta + Reference Manual			£25
Order Processing/Invoicing*			£53
School Administrator			£118

** Requires System Delta*

NEW Business Accounts Packages
Nominal Ledger, Order Processing/Invoicing, Purchase Ledger, Sales Ledger & Stock Control
Price: **£78** per Module or
£299 for the complete Software Suite

ULTIMUM – Archimedes A3000 Podule Racking System



THE ONLY LOGICAL WAY TO EXPAND YOUR A3000 COMPUTER

The accepted standard for Archimedes computer expansion is the Acorn Podule, designed initially to fit the old 310, and also for the later A400 and A400/1 series micros. The podules fit inside these computers up to four at a time. The A3000 is the little brother of the family, but can only have one podule at a time, plugging into the back of the computer.

Other attempts have been made to expand the A3000 by trying to introduce a 'mini-podule'. This is impractical for many reasons, amongst which is the reluctance of manufacturers to produce them. Nobody wants to re-design podules already produced. Some cannot be produced on a 'mini-podule' as they are far too complicated and simply wouldn't fit.

Watford Electronics listens to the demands and requirements of its customers, and we are glad to say that we have come up with the only real solution to the A3000 expansion problem. The ULTIMUM Podule Racking System allows up to three FULL SIZE standard Archimedes 300/400 series podules to be fitted to the computer. In addition, there is also provision for a hard disc drive and a podule to be fitted internally.

Since the ULTIMUM Podule Racking System takes proper full size podules, you will be able to use any of the currently available peripheral equipment, from companies like Computer Concepts, Armadillo, Acorn and of course, our own brand.

Fitting the podules to 'ULTIMUM' is simple. They are neatly fitted inside the metal case of the rack, avoiding the previously untidy method of hanging the podule off the back of the computer, risking damage to both, it and to the computer.

'ULTIMUM' has its own power supply, so no strain is put on the A3000 power supply. There is also an IEC mains output socket for an Acorn type monitor so reducing the number of plugs required to go to the mains. The ULTIMUM is rigidly clamped over the top and under the computer, and allows direct access to the floppy disc drive and reset button, rather than obstructing access as on other systems. The mounting method employed is so firm that the computer could even be safely transported without the assembly falling apart.

Price: £125

Archimedes A300/A400 SCSI Hard Disc Offer
(while stocks last)

100MB Hard Disc Upgrade complete with Controller card, Cables, Formatter and Manuals

RRP: £1030
Offer Price: £475

Archimedes to BBC Serial Link Mk 2

Using this simple data link, it is possible to solve all your BBC to Archimedes data transfer problems. The kit is supplied with a disk, and the necessary cable to connect the two computers.
New RISC OS Version **Only £15**

Archimedes External Disc Drive Interface

With this interface it is possible to connect almost any 5.25"/3.5" disc drive with its own power supply to the Archimedes. Upto 4 disc drives can be connected. Fully Buffered Board. NO SOLDERING is involved. Supplied complete with necessary lead.
- A300/A3000 £21
- A400 £25

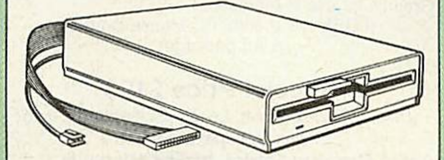
Special Education Prices

All education establishments qualify for special education prices on micros, etc. Please write in or telephone (0923) 37774 or 50335 for written quotation.

BBC MASTER

MASTER 128K Micro incl. Acorn's View, Viewsheet, ADFS, BASIC Editor & TERMINAL plus FREE OFFER (see below) **£399** *(carr £7)*

FREE OFFER



A 5.25" Double Sided, 40/80 track switchable 400K Disc Drive complete with cables and a Utilities disc incl. 2 games, plus

Gemini's OFFICE MATE & OFFICE MASTER packages on Disc consisting of: Database, Spreadsheet, Beebplot graphics. Accounts packs: Cashbook, Final Accounts, Mailist, Easyledger, Invoice & Statements, Stock Control.

FREE with every BBC Master purchased from us during June

ADD-ONs & ACCESSORIES

Turbo 65C102 Add-on Module	£115
Econet Module for the Master	£45
Twin ROM Cartridge for Master	£9
Quad ROM Cartridge for Master	£14
Master Reference Manual I	(No VAT) £14
Master Reference Manual II	(No VAT) £14
Master Advance Ref Manual	(No VAT) £17
64K Upgrade Kit for B+	£32
Acorn 1772 DFS Kit complete	£49
ECONET Upgrade Kit for BBC B	£42
ALL ECONET UPGRADES Available	
ARIES' IEEE Interface for BBC B & Master	£238
Morley Teletext Adaptor with ATS Rom	£99
Ecolink	£270



CREDIT CARD 24 HOUR Ansaphone Hot Lines (0923) 50234 or 33383

Desk Top Publisher

Acorn's Archi DTP Package	£125
Impression 2 DTP Pack	£135
Impression Junior	£79
Tempest DTP Package	£95

Archi Wordprocessors

Pendown Archi	£49	Archie Spell Master	£39
Wordwise + Disc	£24	PD Spellchecker	£40
Image Writer	£25	View	£45
Interword Disc	£24	Graphic Writer	£23
1st Word Plus – 2	£69	EasyWord	£30

Databases

AlphaBase	£36	Multistore	£195
Knowledge Organiser	£45		

Spreadsheets

Intersheet Disc	£24	Viewsheet	£45
Sigmasheet	£39	Schema	£92

Business Graphics

GammaPlot	£39	Sigmaplot	£39
Interchart Disc	£20		

Integrated Packages

- Logistix £79 • Pipedream 3 £119
- Desktop Office – Database, Graphs & Charts, Wordprocessor Spreadsheet, Communications £98
- Desktop Folio – Wordprocessor, Desktop & Interactive Publishing. Ideal for school environment. £85

Watford's Scottish Dealer

We are pleased to announce the appointment of Messrs Computer Depot as Watford's official Scottish Dealer. The full range of our BBC/Acorn products is now available from their Dundee, Edinburgh & Glasgow shops. Their technical staff will be very happy to discuss all your peripherals' requirements.

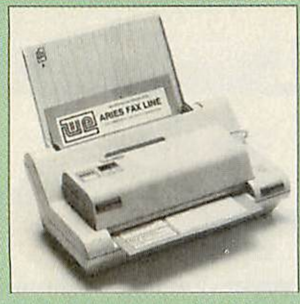
Education Software

- Advanced Folio: 7-14 years. Has the simplicity of a basic wordprocessor with the presentation quality of a Desk Top Publisher £38
- Colourcopter & Numbercopter: 4-7 years. Flying start in pre-reading and pre-number skills
- Colourcopter includes 7 programs to develop matching, sorting, coordination, letter & word recognition £28
- Numbercopter: Includes 8 programs to develop memory, sequencing, logic, number, more and gone away, word order and rhythm skills £28
- Best Four languages 5-11 years: Four best selling programs which encourage children to work together to improve their linguistic ability £33
- Hands on Spelling 5-11 years: Promotes a visual approach to mastering spelling, linking the skill with other National Curriculum areas as hand writing, talking and reading. £30
- Asian Folio – Gujarati 80T £45
- Best Four Languages £35
- Best Four Maths £35
- Frieze 7-16 years £37
- Kaleidoscope 7-16 years £37
- Merlins Castle £22
- Maths 9-13 years £25
- Number in the National Curriculum £55
- Screenprint pack of 5 5-16 years £150
- Time Traveller 7-16 years £40
- The Lost Frog £22
- World Map Study 7-16 years £35

(More Educational software on page 10)

Continued→ → → → → → → → → →

Archi A4 Scanner



This new A4 image scanner from Watford Electronics is supplied complete with ROM based podule software. Features provided include facilities for zooming in on an image and inverting the image in X and Y directions, saving and printing of the sprite created. Interactive help is supplied using the !HELP application on the Acorn applications discs.

The 216mm scanning width can cope with both desktop scanning of single sheets, photographs, diagrams, etc., with its fast ten page automatic document feeder, but it can also detach from the feeder to become a convenient hand-held full page scanner for larger documents or pictures.

Scanned image control can be freely adjusted in increments of 10 dots per inch from 100 up to 400 dpi resolution with 64 levels of grey scaling. A built in shading controller and manual brightness control achieve optimum image clarity.

Unlike some scanners, which use a red light source, the Watford scanner uses a yellow/green source which vastly improves the light/dark contrast, thus eliminating the effect where any red-based colours are faded down to white and so do not show up in the scanned image.

All these features and facilities combine to make the Archi Page Scanner the fast and convenient way in which to add that extra impact, interest and clarity to documents, reports, instruction sheets, manuals, news letters, etc., from your Archimedes DTP package.

Introductory Prices:

Archi A4 Scanner	£349
Sheet Feeder for above	£95
Scanner + Sheet Feeder	£419

Z88 Portable Micro



£185

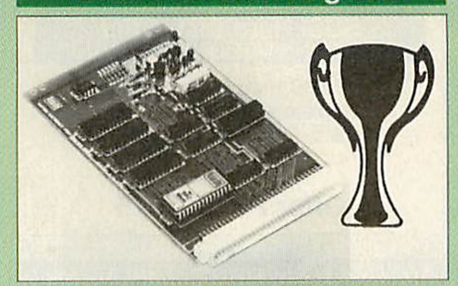
FREE

With every Z88 purchased from us, we are giving away absolutely FREE, a Z88 to BBC Interface Link, 4 rechargeable batteries and a compact Mains Battery Charger worth £38.

Z88 ACCESSORIES

• 32K RAM Pack or 32K EPROM Pack	£18.00
• 128K RAM Pack or 128K EPROM Pack	£42
• 512K RAM Pack	£175
• Z88 Eprom Eraser Unit	£33
• Z88 Spellmaster for Pipedream	£51
• Z88 Carrying Case	£8
• Z88 Computing Book	£9.95
• AA Nicad Rechargeable Battery	£1.50
• Battery Charger Compact & Fast	£6
• Z88 Serial Printer Cable	£8
• Z88 Parallel Printer Cable	£25
• Z88 to Archi Link	£15
• Z88 to BBC Link £20 • Z BASE	£56
• Z88 to PC Link II £30 • Z TAPE	£42
• Z88 to Macintosh £52 • Z TERM	£42
• Z88 Mains Adaptor £9 • Z88 Modem	£149

Archi Real-Time Digitiser



Now supplied with NEW RISC OS Version Software

Watfords' Archimedes Video Digitiser is the most sophisticated digitiser ever designed for a micro. It provides a fast and flexible means of capturing images from a video camera or recorder for display and manipulation on the Archimedes range of Micros. Off-air televison signals may also be digitised via a video recorder or TV tuner. Please write for further details.

Price £175

A Set of Colour Filters for colour image grabbing using a video camera	£16
New Risc-OS Software Upgrade	£39

Archi Graphic Tablet



The Archi Graphic Tablet offers performance and accuracy comparable to other tablets priced at well over £400, and has the useful addition of a liftable cover, which can hold tracing material or menu templates securely. The package is supplied complete with sophisticated Archi software. (Now, fully LinCAD compatible. Recommended by Linear Graphic for use in Education).

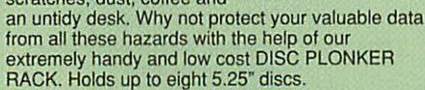
(FREE this month, PC Mouse Drivers & Art package)

Special Price £199

(Price includes Tablet, Leads, Software & Puck)
Stylus Optional Extra **£15**

Archi Graphic Tablet Junior. Working area 9" x 6". Price includes Stylus **£125**

Disc Plonker Rack



When using ones micro, there is a tendency to have more than one Disc on the desk. This exposes them to the hazards of fingerprints, scratches, dust, coffee and an untidy desk. Why not protect your valuable data from all these hazards with the help of our extremely handy and low cost DISC PLONKER RACK. Holds up to eight 5.25" discs.

Protection at Only: £2

Acorn & Watford DFSs

• Watford sophisticated DFS ROM	£16.00
• Watford DFS Kit complete	£69.00
• We will exchange your existing ROM for Watford's ultimate DFS ROM at only	£12.00
• DFS Manual (comprehensive)	£6.95
• Acorn DNFS ROM	£17.00
• Acorn ADFS ROM only	£25.00
• Acorn 1772 DFS ROM Kit	£49.00

(The single Density DFS system is now old technology. Like Acorn, Watford too have decided to replace it with the their more up-to-date 1770 DDFS interface. We have informed most of the software houses of this decision in order that they can ensure compatibility with our highly sophisticated and fully Acorn compatible DDFS).

Watford's MkII 1772

Single/Double Density DFS

Many of our customers have wanted to use our superior DDFS and Acorn ADFS together. Now our Mk II DDFS Board with its 1770 Disc Controller, has been adapted to allow the use of Acorn ADFS as well. It also has all the commands of the Acorn's 1770 DFS, plus the added features.

Added features include:

- Acorn ADFS compatible – Use ADFS on our DDFS board.
- Tube host Code – No longer any need to have the DNFS in your machine to use Co-Processors, even the CoPro and Master 512.
- Auto 40-80 Track sensing – no need to fuss with 40/80 track switches (even works with protected disks).
- An extremely powerful 8271 emulation – ensuring compatibility with almost all software.
- New low profile – small footprint board.
- Fits with all third party ROM boards.
- Option to double the speed of file handling operations – BPUT and BGET.
- Operates in both single and double density modes.
- OSGBPB has been recoded, increasing still further the speed of file handling.

Please note that not all DDFS's are capable of providing either the full 80% storage increase or of allowing a file the full size of the disk – Ours allows both of these!

If you already have a DDFS (any manufacturer), and wish to upgrade to our MkII version, then simply return your existing ROM and DDFS board and we will supply the new DDFS for only **£39.00.**

• SPECIAL PRICE	£44.00
• DDFS Manual (No VAT)	£6.95
• We will exchange your existing DFS Kit for our sophisticated DDFS for only	£30.00

Please note, as the MkII DDFS is a hardware and sofware upgrade, it is not possible for existing Watford DDFS users to simply exchange the ROM for the new version.

3M – Diskettes

3M – SCOTCH Diskettes with Lifetime warranty from Watford Electonics your 3M Appointed Distributor

• *10 x 5.25" S/S D/D 40T (744)*	*£5*
• *10 x 5.25" D/S D/D 40T (745)*	*£5*
• *10 x 5.25" S/S D/D 80 Track (746)*	*£7*
• *10 x 5.25" D/S D/D 80 Track (747)*	*£7*
• *10 x 5.25" 1.6M D/S D/D High Density for IBM XT and AT*	*£11*
• *10 x 3.5" S/S D/D 40/80 Track*	*£7*
• *10 x 3.5" D/S D/D 40/80 Track*	*£8*
• *10 x 3.5" Double Sided High Density*	*£13*

Top Quality 3.5" & 5.25" Diskettes

To complement our range of Quality Discs and Disc Drives. WE are now supplying SPECIAL OFFER packs of 10 Lifetime guaranteed discs. Each disc has a reinforced hub ring. Supplied complete with selfstick labels and a Plastic Library Disc Box.

• *10 x **M3** 3.5" D/S D/D 80 Track*	*£7*
• *10 x **M9** 3.5" D/S High Density*	*£12*
• *10 x **M4** 5.25" S/S D/D 40 Track*	*£5*
• *10 x **M5** 5.25" D/S D/D 40 Track*	*£5*
• *10 x **M7** 5.25" D/S D/D 80 Track*	*£7*
• *10 x **M8** 5.25" D/S H/D Hi-Density*	*£12*
• ***M2** 3" Double Sided*	*£2.50 each*

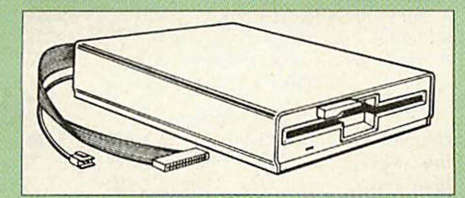


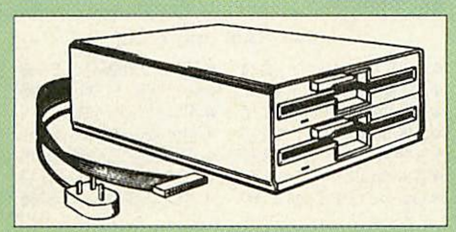
CREDIT CARD 24 HOUR Ansaphone Hot Lines (0923) 50234 or 33383

Quality Disc Drives from Watford

All our Disc Drives are Double Sided and will operate in both Single and Double Density modes. All 5.25" Disc Drives are 40/80 track switchable. For ease of use, the switches are front mounted. Various UK "manufacturers" of disc drives for the BBC micro (more accurately, "packagers" label other manufacturers drives with their own name). We buy the high quality NEC and Mitsubishi drives in large quantities directly from the manufacturers, package them and sell them at "dealer" prices direct to the public.
If you look around the popular BBC micro press, you will find that the prices we quote for the top quality, new slimline disc drives are, virtually without exception, are the best around. These prices, coupled with the backup of one of the country's largest distributors of BBC peripherals provides a superb deal.
Unless you anticipate using dual drives in a fully expanded BBC system for long periods of time with little ventilation, then we suggest that our range of "CL" disc drives without the PSU (Power Supply Unit) would be quite adequate (extensive tests within our workshops have confirmed this). All drives are supplied complete with a SPECIAL UTILITIES Disc, Cables and Plugs. The Drives with power supply have a mains moulded plug for safety purposes. ***Ideal for Schools & Colleges.***
When using a BBC Micro, most people find themselves short of desk space. The Watford's BBC Micro plinths form an ideal way of recovering some of this precious space. Your BBC Disc Drive and Monitor can all occupy the same vertical footprint and still be comfortably situated. With the Watford Double plinth, your Disc Drive is mounted vertically at one side, leaving a very valuable area directly in front of you for such useful items as spare discs, pen, paper, reference manuals, etc. Follow the trend with a Watford plinth. *(Turn to the 6th page of our advert for the Plinths).*
P.S. All our 5.25" Disc Drives with PSU are compatible with the Compact Micro. All you require is our special Compact Disc Drive cables designed by us.

"Test Bureau Approved for Use in Education"





Our Disc Drives conform to BS415

Type	Description	
	Disc Drive without PSU	
• **CLS400S:**	Single, 40/80 track 400K Double sided Drive	**£72**
• **CLD800S:**	Twin, 40/80 track, 800K Double sided Drives	**£142**
	Disc Drive with PSU	
• **CS400S:**	Single, 40/80 track, 400K Double sided Drive	**£82**
• **CD800S:**	Twin, 40/80 track, 800K Double sided Drives	**£155**

Special Cable to connect both 3.5" and 5.25" Disc Drives simultaneously to the BBC Compact £13

Disc Drive/DDFS Offer



- The popular CLS400S 40/80 track switchable disc drive.
- Watford's popular Mk II DDFS Interface (allows up to 720K storage). Will run both in single & double density modes.
- A comprehensive DFS Operating manual

Bargain at Only **£119** (Offer valid until stocks last)

3.5" DISC DRIVE

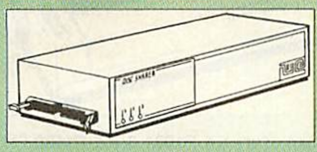


These top quality 3.5" Double sided, 80 track, are attractively finished in BBC beige. They are supplied complete with all cables and a Utilities Disc.

Type	Description	
	Disc Drive without PSU	
• **CLS35:**	Single Disc Drive, 400K	**£62**
• **CLD400S:**	Twin Disc Drives, 800K	**£109**
	Disc Drive with PSU	
• **CS35:**	Single Disc Drive, 400K	**£83**
• **CD35:**	Twin Disc Drives, 800K	**£126**

(P.S. CS35 is supplied in a twin case with a blanking plate to enable easy expansion to a dual drive at a later stage)

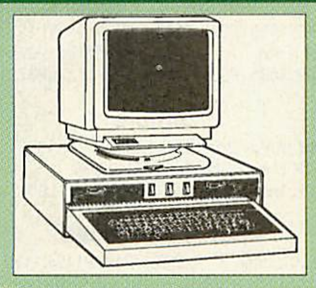
Disc Drive Sharer



(Ideal for educational establishments)
A low cost alternative to the Econet system.Watford's Intelligent Disc Drive Sharer allows you to connect 3 BBC micros (model B, B+ and Master series) to a single or double disc drive. Running under any DFS or DDFS, this intelligent unit will automatically queue the computers. Each computer has a status light dedicated to it. If it is green you will get immediate access to the disk, and red means that you are next in line. The unit plugs directly into the disc drive socket on each computer and is powered by the mains. (N.B. Not for use with ADFS.)

Price includes 3 Cables **£55**

Disc Drives in Monitor Stand



• **CDPM 800S** – Twin 5.25", 800K Double sided 40-80 track switchable disc drives mounted in an attractively finished Beige colour plinth for the BBC B & Master 128K micros. Supplied complete with integral power supply, cables and Utilities disc. The mains switch with neon On/Off light indicator, and the two 40/80 track switches are mounted on the front panel for ease of use.

£165

• **DP35 800** – Same as above except, one disc drive is a 5.25" and the other is 3.5".

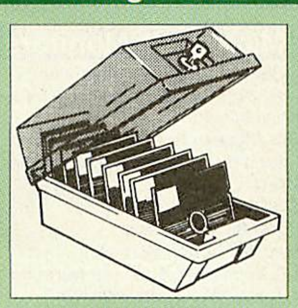
£154

Floppy Head Cleaner Kit

The heads in floppy drives are precision made and very sensitive to dirt. The use of cleaner Kit is a sensible precaution against losing valuable data. It is recommended to clean the drive head once a week. it is very simple to use. Available in 3.5" & 5.25", please specify.

Price £4

Antistatic Lockable Disc Storage Units

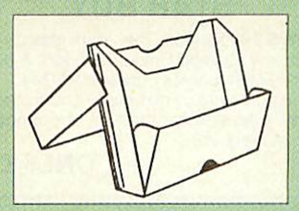


Gives double protection – Strong plastic case that affords real protection to your discs.
Antistatic helps avoid data corruption whilst in storage. The smoked top locks down.
Dividers and adhesive title strips are supplied for efficient filing of discs.

• **M35** – holds up to 50 5.25" discs	**£4.95**
• **M85** – holds up to 95 5.25" discs	**£6.95**
• **M25*** – holds up to 25 3.5" discs	**£4.95**
• **M50** – holds 50 3.5" discs	**£6.50**
• **M10** – holds 8 of No. 10 Data Cartridges	**£15**

* Not lockable

Plastic Library Cases



Holds up to 10 x 3.5" Discs.	**£1.50**
Holds up to 10 x 5.25" Discs.	**£2.00**

Dust Covers (For our Disc Drives)

Single CLS (without PSU)	**£3.20**
Single CS (with PSU)	**£3.25**
Twin CLD (without PSU)	**£3.85**
Twin CD (with PSU)	**£3.90**

Disc Albums

Attractively finished in black leather-look vinyl. Stores up to 20 discs. Each disc can be seen through the clear view pocket.

£4

Special Bulk Offer on Discs

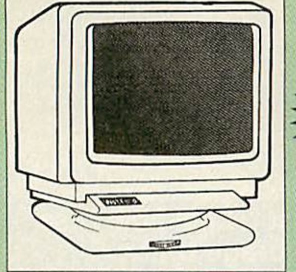
(Supplied packed in Anti-Static Lockable Storage Units)
(Lifetime warranty on Discs)



BULK PACK DISCS in lots of 100

Type	S-S 40T	D-S 40T	D-S 80T
• Without Sleeves 5.25"	£30	£35	£40
• With Sleeves 5.25"	£33	£38	£43
• 3.5" D/S D/D		£29 for 50	£52 for 100

Continued→ → → → → → → → →





Microvitec Monitors

- 1431 – Standard Resolution Monitor £169
- 1451 – Medium resolution, suitable for word processing in mode 0 £209
- Cub3000 Medium Res for A3000 £189
- 1441 – High res, exceeds the capabilities of the BBC Micro £359
- 2040 CS 20" Hi Res £675
- Dust Cover for Microvitecs £5.50
- Touchtec 501 Touch Screen £239

Now 3 years Parts & Labour warranty on all Microvitec Monitors

Multiscan Colour

• Eizo 9060S	£389	• NEC 5D	£1299
• Eizo 9070S	£579	• Taxan 770LR	£379
• NEC 2A	£255	• Taxan 775	£375
• NEC 3D	£345	• Taxan 795-PC	£425
• NEC 4D	£679	• Taxan 875	£725

- VIDC Enhancer Board £25

(P.S. Taxan 795 monitor is supplied with a FREE VIDC enhancer board)

Philips

- BM7502 12" Hi-res Green Monitor £70
- CM8833 14" Med. Res Colour Monitor £178

STAR BUY

- **PHILIPS 14"** Medium Res, dark glass, attractively finished Colour Monitor. A push-button switch toggles between Hi-Res monochrome green text mode and full colour display. (Please state the type of Connecting Lead you require).

ONLY £176

Dust Cover for Philips Monitors £6
(Securicor carriage on Monitors £7)

Spare Monitor Leads

BNC Lead for Zenith or Philips £3
Skart Monitor Lead £5
RGB lead for TAXAN Monitors £3
Archimedes Colour Monitor Lead £7.50

Anti Glare VDU Screen

These extremely effective, easy to install, 12" & 14" VDU screens eliminate harmful glare, improves contrast on colour monitors. Increases productivity in offices. A must for wordprocessor users.

£12

Canon Bubblejet Printers

	Printer	CSF	D'ble Bin	Ink Cart
BJ10E	£205	£54		£18
BJ300	£354	£88	£65	£12
BJ330	£399	£110	£79	£12

- Spare Battery pack for BJ10E £33

NEC Pinwriter Printers

• P20	£198	• P70	£485
• P30	£257	• P90	£655
• P60	£379		

Be Satisfied Before You Buy

We have on display, various Micros, Printers, Disc Drives, Monitors, etc. Call in at our showroom to evaluate before you buy.

Concept Keyboards

Standard A3 Keyboard with BBC Software £143
Standard A4 Keyboard with BBC Software £117
Archi A3 Keyboard £144
Archi A4 Keyboard £118

FREE On-Site Maintenance

This month we are also offering at no extra cost to all our customers, 12 months, On-Site Maintenance on all Multiscan colour monitors, all Panasonic printers, and all Laser Printers, Roland Plotters and of course the full range of Archimedes micros. Should the machine fail, simply telephone the maintenance engineer, who will call in within 12 working hours.
(Offer applicable only when bought at prices advertised in this advert. UK mainland only).

Hewlett-Packard Printers

• # Desk Jet 500	£309	• Paintjet XL	£1125
• Desk Writer (Mac)	£482	• Quiet Jet Plus	£359
• Desk Jet Cartridge	£15	• HP Think Jet	£239
• Paint Jet Colour	£589	• Rugged Writer	£839

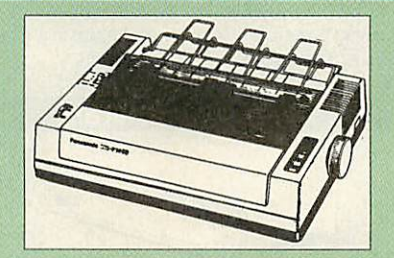
Now 3 years extended Parts & Labour warranty

- Paintjet Cartridges Black £19; Colour £25
- Desk Jet 500 256K RAM cartridge £129
- HP Epson FX Emulation Cartridge for Desk Jet £59

HP Apple Talk Interfaces for

- Scan Jet £299 • Paint Jet £POA
- Desk Jet Unlimited (Book No VAT) £19.75

Panasonic Printers



FREE with every **KX-P1081 & KX-P1180** Printers: A printer lead (please specify type required) and a Dump Out 3 ROM for the BBC Micro or 1,000 sheets of paper for other micros (please specify)

- **KX-P1081** 9pin 80col. 144/28 cps £122
- **KX-P1180** 9pin 80col. 192/38 cps £129
- **KX-P1123** 24pin 80col. 192/63 CPS £158
- **KX-P1124I** 24pin 80col. 192/63 CPS £215
- **KX-P1624** 24pin 132col. 192/63 CPS £299
- **KX-P1695** 9pin 132col. 330/86 CPS £299
- **KX-P1654** 24pin 132col. £429

Above prices include FREE, Watford's 12 months on-site maintenance

Panasonic Accessories

Cut Sheet Feeders

KX-P1592/1595 (P32)	£175	KX-P1540 (P35)	£175
KX-1124 (P36)	£85	KX-P1180 (P37)	£79
KX-P1624/1695 (P38)	£124	KX-P1123 (P37)	£79

Buffers

P12 4K buffer Board for 1081 £55
P42 32K buffer Chip for 1592/1595 £16
P43 32K Buffer Chip for 1540/1124/1180 £16

Serial Interfaces

P17 P1081/1592 £32 **P19** P1124/1180 £55

Citizen Printers

120D Plus	£96	124D Printer	£138
Prodot 9	£205	Prodot 24	£225
Prodot 9X	£245	Swift 24#	£205
Swift 9	£138	Swift 24X	£279

- Prodot Cut Sheet Feeder £120
- Swift 24 Colour Option £29
- Swift 24 Ribbons Black £4 Colour £13

Special Offer this month – A FREE Colour option cartridge with every Swift 24 printer purchased from us.

Star Printers

- **LC10** 9pin 80col. 144/36 CPS £112
- **LC15** 9pin 136col. 180/45 CPS £180
- **LC24-10** 24pin 80col. 180/60 CPS £150
- **LC24-15** 24pin 136col. 200/67 CPS £295
- ***FR10** 9pin 300/76 CPS 31K 16 fonts £229
- **FR15** Wide carriage version of above £290
- ***XB24-10** 24pin 80col. 240/80 CPS £299
- **XB24-15** 24pin 80col. 240/80 CPS £365
- **XB-24** Colour Kit £29
- **LC-200** Colour 9pin 80col. 180/45 CPS £158
- **LC-24-200** 24pin 80col. 222/67 CPS £189
- **LC24-200** Colour 24pin 80col. 222/67 CPS £222

*FREE Colour Ribbon with these printers

Star Accessories

Cut Sheet Feeder

LC10/200/24-10	£65	LC15/LC24-15	£125
XB24-10	£80	XB24-15	£139

Serial Interfaces

SPC-10 LC10; LC10-II; LC10-Col; LC15; LC24-10; LC24-15; LC-200; LC24-200 £49
8K Ser LC-200; LC24-200; FR10; FR15; XB24-10; XB24-15 £64

Paper Roll Holders

LC-200; LC24-200; LC24-200 colour £29

Buffers

32K Ram Card for LC/XB24-10; 15; LC200 £55

Ribbons

LC10; LC10-II; LC15	Black £4;	Colour £6
LC-200; LC24-200	Black £5;	Colour £12
XB24-10; XB24-15	Black £5;	Colour £12

Laser Printers

• Canon LBP-4	4ppm	£655
• Canon LBP-8 IIIR	8ppm	£1505
• Canon LBP-8 IIIT	8ppm	£1389
• Epson EPL7100	6ppm	£689
• HP Laserjet III	8ppm	£1025
• HP Laserjet IIID	8ppm	£1539
• Laserjet IIIP	8ppm	£689
• Panasonic KX-P4420	8ppm*	£648
• Panasonic KX-P4450i*	11ppm*	£1025
• Panasonic KX-4455 Postscript	11ppm*	£1699
• Qume Crystal Print Publisher 2		£1899
• Star LP-8 III		£979
• Star LP-8 Star(post)script		£1195
• Star LP-4 4ppm		£705
• Star LP-4PS Postscript 4ppm		£875

* Now 2 years warranty

Laser Toners

Canon 2 & 4	£54	Laserjet II & IIP	£55
Epson GQ	£18	Laserjet III	£75
Star LP-8	£69	Qume Crystal	£56
KX-P4420/50	£22		

Laser RAM Upgrades

• IIP & III 1MB	£74	• EPL7000 2M	£365
• IIP & III 2MB	£109	• GQ5000 512K	£95
• II & IID 1MB	£76	• KX4420/50 1M	£115
• II & IID 2MB	£112	• KX4420/50 2M	£159
• II & IID 4MB	£299	• KX4420/50 4M	£349
• Canon LBP4 1M	£175	• Star LP8 1M	£143
• Canon LBP8 2M	£150	• Star LP8 2M	£285

Laser Drum & Developer

- Epson Drum GQ5000 £93 EPL7100 £129
- Panasonic 4420 Drum £60 Developer £59
- Panasonic 4450 Drum £93 Developer £80
- Qume Drum £76 Developer £56

Jetpage Postscript Cartridge

- HP IIP/III £255 IID & IIID £265

NEW – HP Laserjet

Various Font Cartridges £45
Superset Font £195

Integrex Colour Jet

- Colour Jet 132 Printer £515
- Paper Roll £6.50
- BBC Screen Dump Software £10
- Colour Cartridge £19.50
- Black Cartridge £11.25
- 100 A4 OHP transparencies £55
- 8K Serial Interface Optional £123

Watch this space for our NEW LAUNCH for Archimedes micro products

Epson Printers

DFX5000	£1089	LQ860 Colour	£465
DFX8000	£1999	LQ1050+	£475
EX1000	£456	LQ1060	£599
FX850	£283	LQ2550+	£709
FX1050	£358	LX400	£109
FX1060	£599	LX850	£150
LQ400	£166	SQ850	£439
LQ550	£209	SQ2550	£645
LQ850+	£385		

Cut Sheet Feeders for

LX400/800/850/LQ400/500/550	£69
EX800/FX800/850/LQ800/850	£130
FX/LQ 1000/1050/SQ850	£159
LQ 2550 £390 SQ2550	£390

Tractor Feed for

LQ800 **£44;** LQ850/FX850 **£69;** LQ1050/FX1050 **£85;** LQ2500 **£90;** LQ2550 **£90.**

Accessories

- EX800/1000 Colour Option £45
- EX800/1000 Colour Ribbon £14
- LQ2500 Colour Option £65
- Multifont Card for LQ550/850/1050 £95

Epson Printer Interfaces

All these interfaces fit inside the printer

RS232	£32	RS232 + 2K Buffer	£52
IEEE 488	£95	RS232 + 8K Buffer	£75

Printer Leads

BBC Centronics 4' long	£5
BBC Centronics 6' extra long	£7
Compact's Special Centronics Lead	£7
Archimedes Printer Lead 6'	£6
Nimbus Centronics Lead	£6
IBM/Archimedes Parallel Lead 6'	£6
IBM/Archimedes Parallel Lead 5 metres	£13
IBM/Archimedes Parallel Lead 10 metres	£19
Double Ended 36 way Centronics Lead 4'	£7
Double Ended 36 way Centronics Lead 6'	£9
MSX Centronics Parallel Lead 4'	£12
RS232 Leads (Various)	P.O.A.
IBM Keyboard extension lead coiled	£5

Plotters

- HP7440 £425 • HP7475 £599

Roland Plotters

- DXY1100 £515 • DXY1200 £645
- DXY1300 £845 • DXY2500 £2375
- DPX3500 £3289 • Sketchmate £379
- Roland plotter Pens, Fibre tip £7.50

Roland SketchMate

The Intelligent Graphic Plotter

It is very compact and lightweight. In restricted space, it can be operated in a tilted position. Is compatible with virtually all CAD software as well as a wide range of business softwares. Specifications: Plotting area: 297 x 216mm. Number of Pens – 8. Magnetic Paper holder. 5K Buffer. Parallel and RS 232 Serial interfaces. Accessories: 8 pens, AC Adaptor, 4 x Magnetic paper holders, User manual, marking sticker, Rubber sticker, 10 x A4 test paper, 2 x A4 OHP transparency film. Dimensions: 360(W) x 410(D) x 105(H)mm. Weight 2.6 Kgs.

£379



CREDIT CARD 24 HOUR Ansaphone Hot Lines (0923) 50234 or 33383

Listing Paper (Perforated)

- 1,000 Sheets 9.5" x 11" Fanfold Paper £7
- 2,000 Sheets 9.5" x 11" Fanfold Paper £11
- 1,000 Sheets 9.5" x 11" NCR 2 Part Fanfold £21
- 1,000 Sheets 15" x 11" Fanfold Paper £9
- 2,000 Sheets 15" x 11" Fanfold Paper £16
- 1,000 Sheets true A4 Fanfold Paper 70gms £11
- 2,000 Sheets true A4 Fanfold Paper 70gms £21
- Teleprinter Roll (Econo paper) £4

(All our Fanfold paper is Micro perforated leaving a smooth clean edge when the tractor feed strips are detached).

Carriage 1K Sheets £2.50, 2K Sheets £3.00

Printer Labels

(On continuous fanfold backing sheet)

1,000 90 x 36mm (Single Row)	£6.00
1,000 90 x 36mm (Twin Row)	£6.25
1,000 90 x 49mm (Twin Row)	£7.50
1,000 102 x 36mm (Twin Row)	£6.75

Special Offer

Hitachi/Acorn 12" High Resolution, ergonomically designed Colour Monitors. Supplied complete with a swivel base and a BBC lead.

Only: £145 (While stocks last)

Printer Ribbons & Various Dust Covers

Type	Ribbons	Dust Covers
Brother HR15/20	£6.00	–
BBC Micro	–	£3.50
BBC Master	–	£4.00
Archimedes Micro pair	–	£9.00
Citizen 120D	£2.75	£4.50
DMP2000	£2.75	£4.75
EX800/1000	£3.50	£5.00
RX/FX80/85/800/MX80	£2.95	–
FX/MX/RX100/1000	£3.95	–
Kaga/Taxan KP810/815	£3.25	£5.00
LQ400/500/550/800/850	£3.25	£6.00
LQ1050/LQ2500	£4.00	–
LX80/86/800/850	£2.75	£4.50
LX400	£3.50	£5.00
M1009/GLP	£2.95	£3.75
NEC P2200	£4.50	£5.00
Panasonic KX1080/81	£3.25	£4.75
Panasonic KX-P1124	£7.50	£5.00
SQ2500	£23.00	£5.50
Star LC10/NL10	£2.75	£5.00
Star LC24-10	£2.95	£6.00
Olivetti Ink Jet Cartridges (set of 4)	£9	

Our attractive Dust Covers are manufactured from translucent PCV. The seams are stitched and edges are taped to prevent splitting due to continuous use.

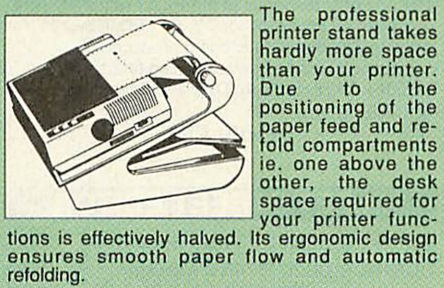
Original Panasonic Ribbons

Guaranteed to last 3 million characters

P110 for KX-P1081, 1592 & 1595 £7
P115 for KX-P1180 £7 **P145** for KX-P1124 £7
P140 for KX-P1540 £8 **P155** for KX-P1624 £10

Colour Ribbons for KX-P1081, 1592 & 1595 Brown, Blue or Red **£9.95 each**

Professional Printer Stand



The professional printer stand takes hardly more space than your printer. Due to the positioning of the paper feed and refold compartments ie. one above the other, the desk space required for your printer functions is effectively halved. Its ergonomic design ensures smooth paper flow and automatic refolding.

80 Column version £24 (carr. £3)
132 Column version £29(carr. £4)

Universal Printer Sharers/Changer

Connect up to 5 Micros to 1 printer or 5 Printers to 1 Micro with our combined, Sharer/Changer. These Units are made to a very high standard. For extreme reliability, they all have Printed Circuit Boards mounted inside the case, (not a Spaghetti Junction of wires). Internal connection is made via high quality ribbon cables.

(Ideal for School environments)

Connects	Serial	Centronics
2 to 1	£16	£17
3 to 1	£22	£24
5 to 1	£32	£36

(Cables extra at £6 each. Please specify type required when ordering)

2 Way Compact Printer Switch

A handy 2 way printer switch. Enables one micro to be connected to 2 printers or vice versa.
Centronics **£18;** Serial **£17**
(Cables extra at £6 each)

Auto Printer Sharer Switch

Connects	Serial	Centronics
2 to 1	£40	£45
4 to 1	£62	£59
8 to 1	–	£89

256k Multi Spooler

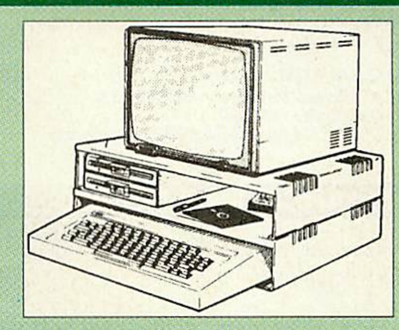
These Auto Centronics Printer Sharers have built-in 256K of Printer Buffers. They can be used as Auto Sharers, Printer Buffers or both.

- 2 In/2 out **£135** • 4 In/2 out **£169**
- 8 In/1 out **£199**

Compact Converter Units

Serial to Parallel **£36** Parallel to Serial **£37**

Plinths for the BBC B & Master 128K Micros

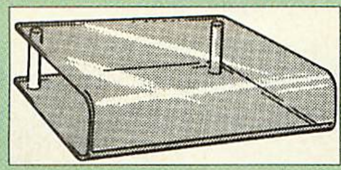


Protect your computer from the heat of your VDU. Our micro plinths have slots for maximum ventilation. The single plinth is suitable for a BBC and VDU, whilst the double height version provides enough room for our stacked disc drive and other peripherals like, Eprom programmer, music unit or simply discs & stationary. The computer slides neatly in the lower section allowing easy access to remove the lid. Colour: Matching BBC Beige.

Single BBC Plinth	420 x 310 x 105mm	**£13**
Double BBC Plinth	420 x 310 x 210mm	**£24**
Single Master Plinth	490 x 310 x 105mm	**£14**
Double Master Plinth	490 x 310 x 210mm	**£26**

(Carr. Single plinth £2; double plinth £3)

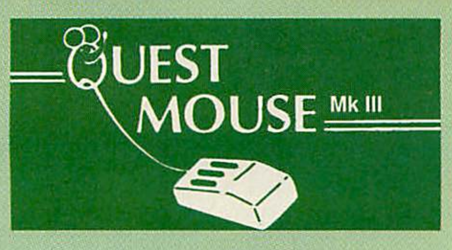
Perspex Printer Stand



Give your Computer System a touch of Class with our elegant, smoke finished Perspex Printer stand.

80 Column version **£16** (carr £3)
136 Column version **£20** (carr £4)

Continued→ → → → → → → → → →



- Quest Mouse III & Quest Paint £59
- Quest Mouse III, Quest Paint, AMX Stop Press & Pagefont £89
- Quest Mouse III only £30
- Quest Paint Software only £34
- Quest Font Disc (22 Text Fonts) £15
- Quest Mouse Mat (Red or Blue or Green please specify) £3
- Quest Colour Dump Disc – This new software allows you to print direct from Quest Paint to your Integrex Colour Printer £18

(P.S. Quest Paint is not compatible with BBC Compact)

Quest Paint is the winner of the BBC Acorn User 1990 Award for the Best Art/Graphics software

ConQuest

Quest combined with ConQuest and Acornsoft GXR ROM make up THE MOST POWERFUL drawing packages available for the BBC range. Quest Paint is able to take advantage of almost any additions to your machine, such as Shadow or Sideways RAM. ConQuest takes this principal even further, by utilising the otherwise normally incompatible Sideways RAM facility by holding pictures in them.

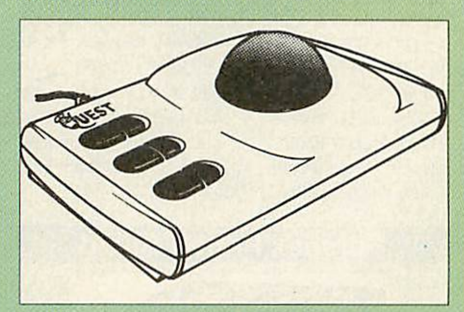
ConQuest ROM Package £30
(Price includes software in ROM and a comprehensive Manual).
(Not Compatible with BBC Compact)

ARCHI Mk II MOUSE

An extremely reliable replacement mouse for Archimedes Micro £32

Quest – Tracer ball

An attractively finished, extremely reliable, mouse replacement, input device. Requires very little desk space. Connects directly to your BBC B, BBC Master or Archimedes Micro.



QT-10 BBC/Master Version **£27**
QT-20 Archimedes Version **£30**

RB2 Marconi TRACKER BALL

RB2 (AMX/Quest compatible) £45
RB2 including Quest Paint £75
RB2-A for Archimedes £46

THE NEW Mk III AMX MOUSE

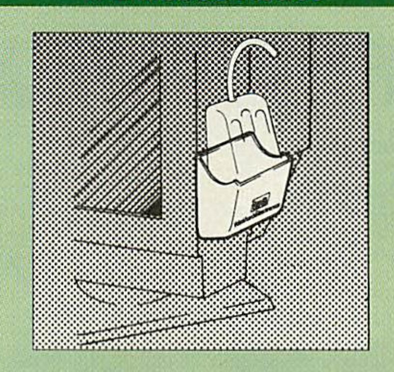
Inc. Super Art package

ONLY: £59 (carr £3)

(Please specify for BBC, Master or Compact)

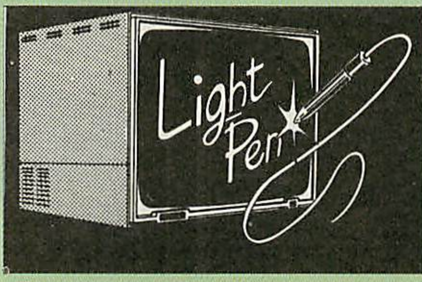
MOUSE MAT	£3
AMX MOUSE ONLY	£29
AMX SUPERART Package	£34
AMX STOP PRESS – A Desktop publishing software. Works with Keyboard, Joystick or a mouse	£32
PAGE-FONTS – Over 20 Fonts for use with AMX Pagemaker	£13
AMX DESIGN (ROM)	£55
AMX XAM Educational	£15
AMX EXTRA EXTRA	£16
AMX MAX A gem of desktop (ROM)	£20

WE Mouse House



Treat your mouse to a cosy Mouse House. This handy little gadget solves the problem of where to store your mouse when it is having a rest. Made of sturdy plastic, the WE Mouse House attaches to the side of your computer, monitor, disc drive or desk.
It protects it from damage when not in use, yet within easy reach when you need it again. At £4 it does not cost a rodent's ransom.

Price £4



Our Mark II Light Pen is the very latest in light pen technology. It is totally insensitive to local lighting conditions and works with many different monitors. The pen only responds to the High Frequency light produced by your monitor/TV. An LED indicates when valid video data is being produced. A conveniently located switch is also fitted. (Price includes FREE software Disc and Operating Manual)

Only £21

FLEET STREET EDITOR

Software pack for BBC Micro	£33
Software pack for the Master	£39
Admin Xtra Disc Utility	£13
Fonts N Graphics Disc Utility	£13

BEEB VIDEO DIGITISER



"Test Bureau Approved for Use in Education"

Using any source of composite video (colour or monochrome) and the Watford Beeb Video Digitiser, you can convert an image from your camera into a graphics screen on the BBC Micro. This uses the full graphics capacity of the BBC micro in modes 0, 1 or 2. The video source may be a camera, video recorder or television, and is connected via the video output socket. The software supplied includes a sophisticated, fast screen dump routine.
Images produced can be compressed, stored to disc, printed on an Epson compatible printer, directly used to generate graphics, analysed for scientific and educational use or converted to other formats e.g. Slow Scan TV or receiving a picture from a remote camera using a modem. The output from the digitiser exactly matches the graphics capability in each mode, with up to 8 levels of grey in mode 2. The unit connects into the User Port and automatically scans a complete picture in 1.6 seconds.

£109 (Carr. £5)

(BBC B+ and Master compatible, except Master with Econet)

(Price includes) Digitiser Unit, Software in ROM & a Comprehensive Manual)

The Beeb HandScan

Hand-held Scanner for the BBC Micro



Watford Electronics are pleased to announce the launch of the first hand held scanner for the BBC Micro. HandScan is a compact unit which will allow photographs, diagrams, or any other documents to be digitised quickly and easily, to then be used in a desk top publishing package, art program, or even in your own Basic programs! These useful devices have been available for faster and more expensive micros for some time, but only now is Watford Electronics able to offer the BBC Micro computer.
The HandScan plugs directly into the 1MHz bus on the BBC while a comprehensive set of utilities provided by the sophisticated ROM firmware. The scanner has a resolution of either 100 DPI or 200 DPI when accuracy is essential. Pictures as wide as 4" may be scanned in mode 0 and various types of dithering may be selected to simulate the grey levels of a scanned picture.
All necessary software has been included in the firmware to allow the scanner to read images directly into our Wapping Editor with little more than the click of the mouse. The digitised picture may then be incorporated into your magazine, newsletter, report or any other document.

Beeb HandScan & Firmware £135



Winner of the BBC Acorn User 1990 Award for the Best DTP/Word Processor

The Wapping Editor

The Wapping Editor from Watford Electronics represents a breakthrough in Desktop Publishing for the Beeb. The package includes a 64K ROM containing ALL the software needed to get into print fast; a very sophisticated graphics module, professional quality typesetting software, a word processor, a comprehensive font editor for designing your own typefaces, and a variety of printer dumps. This mouse-driven system is designed for the BBC B, the B+ and Master computers and will take full advantage of any Sideways and Shadow RAM that may be fitted. It will run under DFS, ADFS and Network filing systems and requires as a minimum just a single 40 track drive.

Included with the system is a utility disc containing several high quality fonts, various utilities and a ROM image of a Support ROM. A comprehensive 100 page manual completes the package. The Support ROM contains routines to allow an area to be rotated to any angle or distorted to any four-sided shape. Also included are facilities to draw ellipses at any angle and sectors, segments and arcs (in Master or BBC B with Acorn GXR). Another of the features of the Support ROM is a 'Turbo DFS' which gives DFS access times comparable with those of ADFS.

Page Layout Section

The Wapping Editor may be used to create pages of any size from an A6 to a full A3 page. If none of the eight default page types suit your purpose, the stand-alone page creation program may be used to create pages to your own requirements. By using proportionally spaced fonts and genuine microspacing it is possible to print over 150 characters across an A4 page. A unique feature of the Wapping Editor is the 'A5 x 2' page size allowing two A5 pages to be printed side by side onto a single A4 sheet.

The graphics module incorporates the facilities like: pencil, brush, airbrush, polygon, circle, eclipse, fill, cut & paste, etc.

Text may be typeset, either justified or unjustified, in any font anywhere on the page. Simply select which font and text document you wish to use, and pull out a rectangle on the page where you want the text to be – it's as simple as that! Multiple columns may be printed just as easily and a special 'expand' feature may be used to expand the microspacing so that the document exactly fits the space defined.

Word-Processor

The integral word processor is the ideal tool for producing your text documents, although text can of course be read in from any of the other popular word processors such as View, Wordwise etc.

The Font Editor

The font editor module will allow you to design your own typefaces or to modify the ones provided on the utility disc. This sophisticated editor has numerous functions designed to take the tedium and frustration out of producing good looking, well balanced fonts. Each character may be individually proportionally spaced and characters of any size up to 16 x 16 pixels may be defined.
Pictures may also be 'grabbed' from a video source by using the Watford BEEB Video Digitiser.

Wapping Editor Software Pack £69
Wapping Editor plus Mouse £89

(Wapping Editor only works with Master Compact if a Mertec Expansion box is fitted)



At the request of many of our customers we are now able to offer training in the use of Wapping Editor DTP package. For further information please telephone 0923 37774 and ask for Tim or Shiraz

Wapping Art Disc

Over 250K of clip art to cut and paste into your Wapping Editor pages. Pictures include maps, transport, people, media, sport, games etc. Two 'ratio' screens for use with hi-res and rotated A5 pages to ensure images are not distorted when printed out.

Music writing symbols in the form of pattern and brush for quick production of manuscripts are included together with staves.

There are two prepared hi-res pages layed out for printing labels, both single and double width. Ready made label designs are included but these can be easily replaced with your own designs.

A Mode 0 screen dump routine is also included. To pack such a large amount of data onto the discs the screens have been compressed and routines to compress and expand Mode 0 screens are included on both discs. Using the packing routine you can archive large numbers of screens onto a single disc.

£15

Wapping Font Disc 1

Sixteen additional fonts, including smaller version of Oberon and Daisy and two new sizes of the standard font for the Wapping editor.
Also included are three Mode 0 screens containing giant 'headline' fonts to cut and paste to create extra smooth headlines.
Supplied complete with instructions. **£12**

Wapping Font Disc 2

This new addition to our Wapping range of DTP software provides you with additional 23 fonts for the Wapping Editor DTP pack. (80 track discs only). **£13**

Laser Direct



By using the power of the Archimedes RISC processor, it offers the best of both worlds – print speed up to 5 times faster than typical Laserjet compatibles – uses outline fonts so that any font can be scaled to any size – works with all programs that use RISC OS printer drivers. Ideal for use with Genesis, !Draw, Acorn DTP, Impression, etc. Includes 50 sheet paper tray and a single sheet/envelope tray. Requires one expansion slot and at least a 2Mbyte Archimedes. A very compact printer, a very low initial cost and very low running costs.

Special Price: £849

- Special High Res Laser Direct Card 600 DPI for Canon LPB4 Laser Printer £325
- LPB4 Printer plus High Res Card £1025

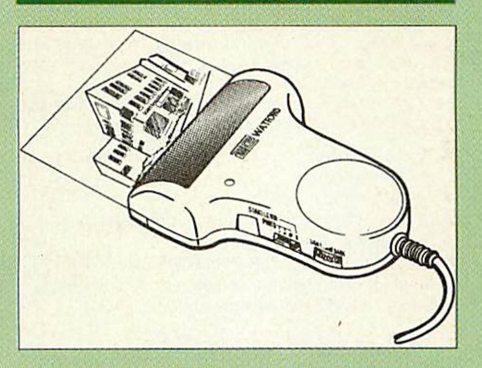
(For demonstration, call in at our retail shop)



CREDIT CARD 24 HOUR Ansaphone Hot Lines (0923) 50234 or 33383

All prices are exclusive of VAT

Archi Mk II Hand Scanner



Watford Electronics is now able to offer a complete hand held scanning package, possibly the most essential addition to any desk top publishing system, for only £149. The package includes the most comprehensive utility software available for the Archimedes, a high quality hand held scanner, and all necessary documentation to get you going straight away.

SCANNER

The scanner is capable of scanning up to an amazing 400 dots per inch (DPI)! The scanning area is 4" wide, and the height is only limited by the maximum amount of memory available. The dot resolution may be switched to 100, 200, 300 or the maximum 400 dpi. One of four operating modes may be selected offering either pure monochrome scanning, or one of three grey level modes. The grey level modes use different size dither patterns to represent up to 16 shades of grey. There is also a dial to allow the "brightness" to be adjusted over a wide range, in order to optimise the quality for any specific image. The scanner interface is a standard, single width, expansion card (podule) which plugs into the Archimedes' backplane. The socket on the rear panel connects the scanner by 1.8 metres of cable.

SCANNER SOFTWARE

Full use is made of the windowing and the multi-tasking facilities of RiscOS. The software is supplied in a 64Kbyte ROM located on the interface board. The scanner appears as a small icon on the desktop icon bar, and the software is retrieved from the ROM simply by clicking on that icon. As you scan a page, the image appears in the scanning window on the screen, scrolling up in real time. The other facilities included in the software are.

Cropping and scaling to any size including stretching and squashing in X and Y direction separately.

Colour tinting.
X and Y flip.

Edge detection which turns solid objects into outlines.

Selective directional copying which allows features (i.e. lines or text) to be made thicker or thinner.

Scanned images may be saved as sprite files or transferred directly into other RiscOS applications (DTP, Draw, Paint) simply by dragging the sprite file into the application's window. Sprites may also be generated using anti-aliasing. This greatly improves picture quality and is particularly effective when scanning material with a range of grey tones, such as photographs. Images can be printed on any printer that is supported by a RiscOS printer driver, with optional settings for portrait or landscape modes, image scale and positioning. Images are printed using the full resolution of the printer and are not limited to the screen resolution.

On-screen help is provided via the RiscOS interactive help facility. Calls are also provided in the ROM for users wishing to write their own software, incorporating the use of the scanner.

AHS-4 Archi 300/400 Version £149
AHS-3 Archi A3000 Version £175

Continued→ → → → → → → → → →

16K Disc Ram Module

(16K Sideways RAM Module)

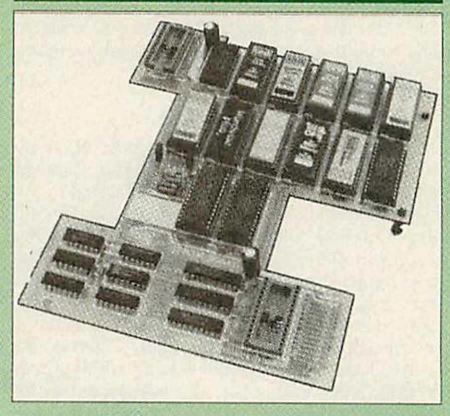
Complete with such features as read and write protection, these new modules from Watford Electronics are ideal for the hobbyist, software developer and ROM collector.
Key points to note about this new addition to the Watford range of products are:

- Write protection (useful in a variety of circumstances)
- Compact construction
- No overheating or overloading problems.
- Free utilities disc supplied
- Can be used as a 16K PRINTER BUFFER.
- Ideal for professional software development.
- Supplied with utilities software disc.

Only: **£29** (carr £2)

Optional Battery back-up fitted **£3**

Solderless Sideways ROM Socket Board



The key features of this new, no fuss, easy to install quality product from BBC leaders Watford Electronics are as follows:

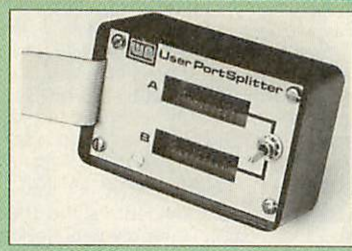
- Increase your BBCs capacity for ROMs from 4 to 16.
- **No soldering required.**
- Very low power consumption.
- Minimal space required.
- Compatible with Torch, DDFS, RAM Card, 2nd Processor, etc.
- Socket 14 takes two 6264 RAM chips.
- Read protect to make RAM "Vanish") allows recovery from ROM crashes.
- Battery backup option for RAM chips.
- Supplied ready to fit with comprehensive instructions.

Price: Only £35
Battery Backup fitted **£39**
Battery Backup only **£3**
16K Sideways RAM **£8.50**
(carriage £3)

- Sideways RAM Utilities Disc for Solderless ROM Board. Includes the options to load and save ROM Images and the facility to use Sideways RAM as Printer Buffer.

Only: £8

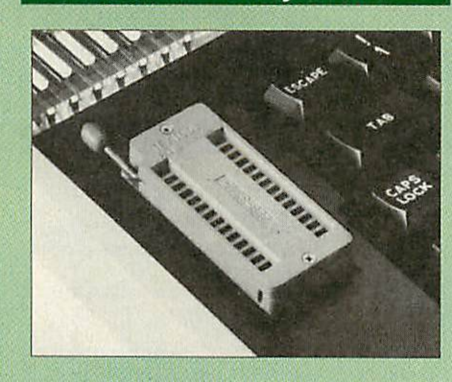
User Port Splitter Unit



Gone are the days when you had to plug and unplug devices from the User Port. This extremely useful little device allows two units to be connected to the User Port simultaneously, and select between them simply by toggling a switch. This device is particularly useful for those people using Quest Mouse and the Watford Video Digitiser or any similar combination

Excellent Value at **£22** (carr £2)

Sideways ROM ZIF Socket System



Allows you to change your ROMs quickly and efficiently, without opening the lid. The ZERO INSERTION FORCE (ZIF) socket is located into the ROM Cartridge's position.

- Very simple to install. NO SOLDERING required. The ZIF (Zero Insertion Force) eliminates the possibility of damage to your ROM pins when inserting & extracting.
- The low profile of the socket allows unrestricted access to the Keyboard.
- All data and address lines are correctly terminated to ensure correct operation of suitable ROMs with the BBC micro. We also supply a purpose designed see-through storage container with anti-static lining, allowing you to store up to 12 ROMs, protecting them from mechanical and static damage.
- This versatile hardware solves the problem of running out of socket space. Simply lift the ROM from the ZIF & insert a different one (No pulling or pushing of Cartridges. It is a must for professionals and Hobbyists alike.)
- BBC, B and B+ compatible.

ONLY **£18** (carr £3)

BBC B Low Profile Cartridge System

Complete System consists of: Low profile ROM Cartridge, Socket housing, Cable assembly, 5 labels and a library storage rack for the BBC B.

• Complete System	**£11**
• Spare Cartridges	**£2.75**
• Spare Rack	**£1.65**

ROM Cartridges for the BBC Master

Will accept the new larger Piggy Back ROMs like: Interword, Interbase, Quest, Conquest, etc

Twin **£9**; Quad **£14**

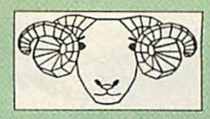
Commander Joystick

Watford Electronics' new Commander Joystick for the BBC B and Master 128K has a unique dual mode of operation giving selective free floating or self centring fully variable control in both X and Y axis directions. Commander is particularly good for flight simulation and drawing programs.

Features:

- Direct connection to BBC Analogue input port – no interface needed.
- Fully compatible with all BBC Joystick controlled games programmes.
- Switchable springs allow selection of floating or centring operation.
- Trim adjusters for both X and Y axes for fine centre adjustment.
- Convenient stick mounted fire button with additional base buttons.

Launch Price: £15



ARIES CORNER

B-32 Shadow RAM Card

Like the BBC B+, the B32 provides 20k of shadow screen RAM and 12k of sideways RAM. Unlike the B+, the B32 has simple software commands which allow the user to reconfigure the RAM as 16k of shadow RAM and 16k of sideways RAM, or all 32k as sideways RAM.

With the B32, the programmer gets up to 28k of RAM available for Basic, Logo, Cobal, Forth, Lisp and BCPL programs in any screen mode. The business user gets extra memory for View, ViewSheet, Wordwise Plus, Interword and many other applications. For advanced applications, the scientific user gets access to a massive 47k of data storage using the Acorn approved ★FX call.

Sideways RAM enables you to load sideways ROM images from disc, allowing you to have a large library of sideways ROMs (subject to the copyright holder's permission) stored on disc. The B32's sideways RAM can also be used to extend any operating system buffer (such as the printer buffer) or to load tape programs into a disc system.

The B32 simply plugs into the 6502 processor socket on you BBC micro – no flying leads to connect and no soldering. Provision of the onboard ROM socket means that the Aries-B32 control ROM does not use up one of your existing ROM sockets.

- Recommended by Computer Concepts for use with their Inter series of ROMs.

Price: **£69** (carr. £3)

Aries B-12 Sideways ROM Board

The B-12 provides a total of twelve sideways ROM sockets (the four in the original machine are replaced by the twelve on the board), all fully accessible by the MOS sideways ROM system. In addition, there are two sockets for sideways RAM, giving up to 16k of RAM using 6264 static RAM chips.

If you do not have a B32 or B20, a small adaptor module (the Aries-B12C) is available at a nominal cost

Price:	Aries B-12	**£36**
	Aries B-12C	**£5**

Aries B-488 IEEE-488 Interface Unit

The Aries-B488 is an interface unit to enable the BBC micro to control and monitor IEEE-488 bus systems. The IEEE-488 bus (also known as the 'GPIB or 'HP IB') is the standard method of interconnecting programmable laboratory instruments and control equipment. Using the B488, up to 15 devices may be connected in a single high-speed data network.

£238 (Carr £3)

Voltmace Joysticks

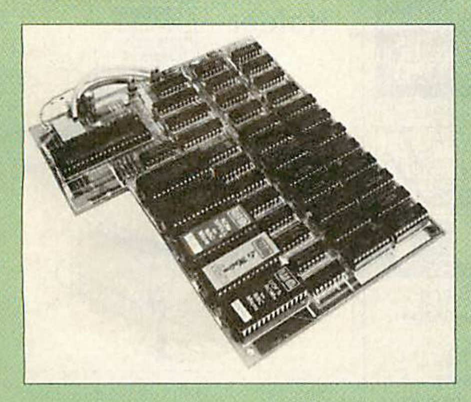
Delta 3B Single Joystick	**£10**
Delta 3B Twin Joysticks	**£15**
Delta 3C Joystick for Compact	**£10**
Delta 14B Single Joystick	**£11**
Delta 14B/1 Adaptor Module	**£12**
Transfer Software Disc-Tape	**£7**
Delta-Cat A mouse eliminator Joystick for the Archimedes	**£24**

Delta Base B



Analogue aircraft style yoke Joystick to run in the analogue port of the BBC B & Master 128 **£25**

ROM/RAM Card



Watford Electronics announced the first ever commercial ROM board for the BBC micro, the Watford Electronics 13 ROM Socket Board 7 years ago. Following the success of this board, we have designed what probably represents the ultimate in expansion boards, the new Watford Electronics ROM/RAM board. This highly versatile and sophisticated board represents the latest in "2nd generation" sideways ROM technology for the BBC micro, designed to satisfy the serious BBC user.

- NO SOLDERING required to fit the board.
- NO User Port corruption (avoids problems with the mouse, modems, Eprom Programmers, etc.)
- Fully buffered for peace of mind.
- Compatible with BBC micros (not BBC+ or Master).
- Total number of ROMs increased from 4 to 8.
- Up to 8 banks of sideways RAM (dynamic).
- Option for 16k of battery backed CMOS RAM (CMOS RAM needs one ROM socket).
- Software Write protect for ALL RAM.
- Read protect for CMOS RAM (ALLEVIATES crashes during ROM development).
- Separate RAM write register (&FF30 to &FF3F).
- Automatic write to currently selected RAM socket for convenience.
- FREE utilities disc packed with software.
- Compatible with our DDFS board, 32k RAM Card, Delta Card, sideways ZIF, etc.
- Large printer buffer.
- UNIQUE fully implemented RAM FILING SYSTEM (similar to the popular Watford DFS).
- ROM to RAM load and save facilities.

The SFS (Silicon Filing System) can utilise up to the full 128k of RAM (with the SFS in any paged RAM) as a SILICON DISC. This behaves as a disc drive, with all the normal Watford DFS features (including OSWORD &7F for ROMSPELL, etc.) to provide an environment that looks like a disc but loads and saves MUCH faster.

The ROM-RAM Board plugs into the 6502 CPU socket. This leaves free all the existing ROM sockets, which can still be used normally.

Any ROM that can be plugged into the BBC micro's own ROM sockets may be used in the ROM-RAM Board.

The ROM-RAM Board is supplied with all ordered options fitted as standard. Upgrade kits (with full instructions) are available for all of the options, for later.

PRICES:

- ROM/RAM card with 32k dynamic RAM **£48**
- ROM/RAM card with 64k dynamic RAM **£65**
- ROM/RAM card with a massive 128k dynamic RAM **£109**

(carriage on ROM-RAM Card £3)

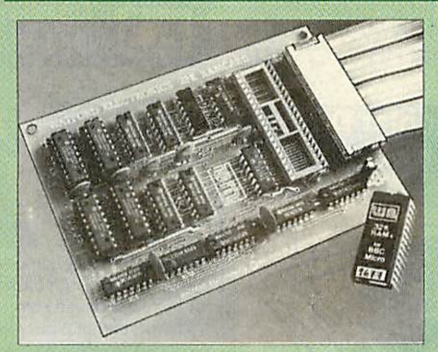
OPTIONAL EXTRAS:

- 16k plug-in Static RAM kit **£9**
- 16k Dynamic RAM for Upgrade **£13**
- Battery backup **£3**
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Complete ROM-RAM board
All options installed **£115**

P.S.
IS your existing ROM Board overflowing with ROMs? Do you need more Sideways RAM? Is your Board unreliable? Then upgrade to Watford, ROM/RAM Board and pay £5 less.

32K Shadow RAM/Printer Buffer Card Expansion Board



A MUST FOR WORD PROCESSING

Don't throw away your BBC B for a BBC B Plus or BBC Master. Just plug the ribbon cable into the 6502 processor socket, and fit the compact board inside the computer. Immediately you will gain not 16k or even 20k, but a massive 32k of extra RAM!!!

- IMPROVE your WORD PROCESSING system, whether disc or cassette based. Don't wait for a slow printer – type in text while printing. TWO JOBS DONE SIMULTANEOUSLY and £100+ saved on a printer buffer.
- "VIEW" Wordprocessor users can now type in letters in 80 columns and have up to 28,000 bytes free – 5 times as much as normal.
- In WORDWISE (or WORDWISE-PLUS), preview in 80 columns with the full 24k of text in memory. This product is recommended as an ideal complement by Computer Concepts.
- Combine GOOD GRAPHICS and LONG PROGRAMS. Use the top 20k of the expansion RAM as the screen display memory, leaving all the standard BBC RAM free for programs. Benefit from MODE 0/1/2 graphics and 28k of program space.
- Use the FULL 32k or the bottom 12k of the expansion RAM as a PRINTER buffer for PARALLEL or SERIAL printers, sound channels, RS432 etc. Print large text files while running long graphics programs, and have all your buffer options available as well (*FX15,21,138, 145,ADVAL etc). Please note only a 12k printer buffer can be used with Wordwise or Wordwise-Plus, due to the way they are written.
- Unique facility to turn ROMs off and on again. Unlike all other ROM managers, this feature does not use 'unofficial' memory. Two bytes of normally user-inaccessible memory on the RAM card are used to ensure ROMs are disabled WHERE OTHER ROMS FAIL.

Only £59 (carr £3)

(Price includes a comprehensive manual and the ROM)

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Wordwise plus

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We are giving away absolutely **FREE**, the superb Word-Aid ROM worth £24, with every WORDWISE PLUS package bought from us.

Word-Aid

The most comprehensive utilities ROM for Wordwise-Plus

Extend the power of your Wordwise Plus word processor with this most advanced ROM from Watford. By utilising the powerful Wordwise Plus programming language, WordAid provides a whole host of extra features, all accessed via a special new menu option. This ROM has been personally approved by Mr Charles Moir, the author of WORDWISE PLUS.

- Alphabetical sorting of names and addresses.
- Text transfer options.
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- Epson printer codes function key option.
- Search and display in preview mode.
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- BBC B, B+ and Master compatible.

Only **£24**

(N.B. Word Aid requires a Disc interface in your Micro)

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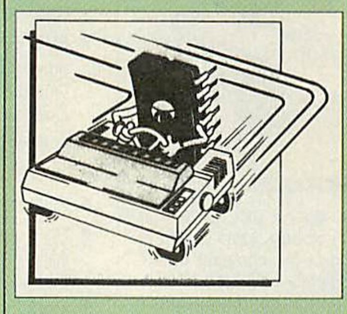
(When ordering please specify for which Micro & 40 or 80 track Disc)

All prices are exclusive of VAT

View Printer Driver Discs

Epson FX & RX 80	£10
Juki & Brother HR	£10

View Printer Driver ROM



View is a powerful word processor, but it seriously lacks in terms of printer driver support. With the View Printer Driver ROM, the View users will find themselves in the realms of advanced word processing.

The VPD extends View's printer command with a series of mnemonic commands. All standard highlight sequences are also supported. A large range of printers are supported by drivers contained within the ROM (the drivers can be downloaded and customised). Printers supported include: Epson's MX, RX, FX, LX, JX80 range, HI80, KP810/910, PW1080, JP101, HR15, M1009, GLP, Panasonic KX-P1081/2, JUKI 6100, etc.

Other printers are readily supported by defining a Printer Driver using the built-in Printer Driver Generator. The features mentioned below are available to both the built in Printer Drivers and user defined drivers (assuming the printer supports the features).

NLQ control, Underline, Bold, Proportional Spacing, Microspacing, Italic, Superscript, Subscript, Condensed, Enlarged, Double Strike, Set lines per inch numerically (e.g. LPI 6), Set characters per inch numerically (e.g. CPI 5), Select printer font, Select printer ribbon colour, Translation sequences, Emulation of BBC Character Set, Simple numeric expressions for certain operations, Full printer setup, Send control codes, Print prompt on screen, Redifinable Pad character, Pause for key press, Prompt to change daisywheel, and Execute ★ command when printing.

Other features include a very powerful on-screen preview, with bold, italic, underline, super/subscript, enlarged highlights, and a special printer driver to allow memory-based text to be previewed by View 1.4. Of course, View 1.4, 2.1 and 3.0 are all supported, as is Shadow RAM and 6502 Second Processors. The BBC B series and Master series of micros are supported. A comprehensive manual is supplied. All in all, a very professional product for the discerning user who wants power at their finger tips.

Price: Only £33



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OFFICE MASTER



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FINAL ACCOUNTS – Will take data prepared by the Cashbook module and produce a complete set of accounts as following: Trial Balance with inbuilt rounding routine; Notes to the accounts; VAT Summary; Profit & Loss A/C; Balance Sheet.

MAILIST – A very versatile program. Enables you to keep records of names and addresses and then print, examine, sort and find them, all with special selection techniques.

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STOCK CONTROL – Allows you to enter stock received, stock out, summary of stock items and current holdings together with details of total cost, total stock to minimum level, units in stock ordering, quantity and supplier detail.

All this for only **£21** (Disc)

OFFICE MATE



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DATABASE – Set up a computerised card index system with powerful search facilities.

SPREADSHEET – Offers many calculation and editing features

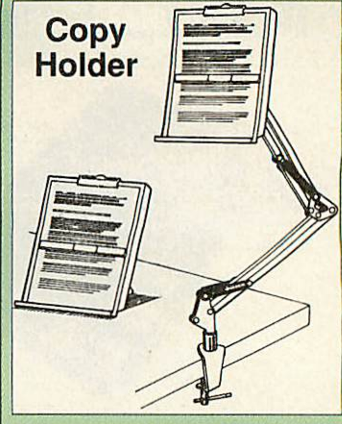
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The Epson RX/FX/KAGA Printer Commands Revealed Handbook

Printer Commands Revealed

So you bought yourself a new printer, because the salesman in the shop showed you how clever it is and impressed you with all sorts of printouts to show its capabilities – he may even have offered you a special price.

However, now that you have got it home and connected it to your BBC microcomputer, you are wondering how to make it perform these magical tasks. The manual seems to give no clues, and when you type in the example programs, the computer throws the LPRINT statements back in your face.

Now what do you do, when this £400 piece of high technology refuses even to move its head, and you have stayed up until 2 in the morning with copious supplies of coffee, desperately trying to print something out? Once again, Watford Electronics comes to your help with our new book entitled 'THE EPSON FX-KAGA PRINTER COMMANDS REVEALED'.

This book describes in plain, easy to understand English, how to use and make the most of your KP810, PW1080A or any other Epson FX80 compatible printers like Panasonic KX-P1080/1, etc., with the BBC Micro, both from Basic and Wordwise.

It describes in detail how to obtain the maximum in graphics capability from your printer and includes full indexes allowing you to cross index the numerous commands. Every command is explained in detail, with an accompanying BBC Basic program and an example of its use from Wordwise.

£5.95 (No VAT)

ALL PRICES EXCLUDE VAT

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Do you have to use both Acorn computers and PC's? Would you like to use your Archimedes or A3000 in PC-emulation mode but are unsure of the new commands?

Although Acorn machines (such as the BBC B, the Master, the Archimedes and the BBC A3000) are mainly used in education, most commercial computers use other operating systems, particularly MS-DOS. As a result school computer users are at a disadvantage when moving into 'business' computing. PCs and other commercial computers use MS-DOS as the operating system, so commands for formatting, copying, backing up, printing and the modem are not the same. Even file names are written differently! And did you know that there is one Acorn command which, if used in MS-DOS, wipes everything in the current directory?

'ACORN TO PC' enables you to change over painlessly. It shows clearly and quicly how, why and where the two systems (Acorn and MS-DOS) differ. As with a foreign language dictionary, you can use the book to transfer either way – from Acorn to MS-DOS, or from MS-DOS to Acorn.

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'ACORN TO PC' is written clearly and concisely by Dr. John Lockley, who has wide experience of writing and broadcasting. He is currently appearing as a regular contributor on Radio 5, and is co-author of 'The Complete BBC Computer User Handbook'.

Price: £15.95 (No VAT)

The Complete BBC Computer User Handbook

If you own a BBC B, B+, Electron, Master 128 or Master Compact, or Archimedes, then this is the book for you. It shows how to get the best from your machine, and how to make it work for you. The general style and level of presentation means that both the expert and beginner alike will feel comfortable with the quality and quantity of the material.

Subjects covered include the general use of computers, hardware design and peripheral devices like printers, disc drives, etc, and Networking. Programming hints and tips and various disciplines for making a better program are discussed in some detail, including debugging of specific errors. Standard programs are covered, such as wordprocessors, spreadsheets, databases, graphics, communications, etc., which brings you neatly on to the subject of using computers in the office or at work – even giving advice on writing and marketing your own programs.

A book you will enjoy to use as a reference, or read from cover to cover, over and over.

Only: **£14.95** (No VAT)

The Complete Mouse User Guide to BBC Micro

This manual has been written to reveal the secrets of the mouse. It explains all the principles required by the hardware and associated software, and also example listings for inclusion into custom programs. The manual first details the basic principles of the mouse and a simple program which uses these principles. This information should be adequate for most applications. However, it is possible to improve the performance of the mouse by expanding on the principles already used in the software. This is again fully explained and an example program given.

It is possible to gain a full understanding of the mouse from this manual. For those not interested in exactly how the mouse functions, complete example programs are also included. These may be typed directly into the micro, without the need for any understanding of the hardware or software involved, enabling the mouse to be used for custom applications.

Price £5.95 (No VAT)

Example programs on Disc £4.95

Beeb PC (BASIC)

Beeb PC Basic is designed for program authors wishing to convert programs so that they will run on IBM personal computers. To convert BBC BASIC programs manually can waste days of valuable time with every occurrence of common statements such as PROC, DEFPROC, TAB, having to be changed.

Beeb PC (BASIC) automates many of these changes, and will convert majority of BBC statements that are invalid for IBM BASIC into equivalent acceptable statements. In addition BBC BASIC data files can be converted to IBM BASIC format, with support provided for all BBC data formats:- INTEGER, REAL & STRING.

Price: £38

Beeb DOS 3.0
(Now reads Archimedes Discs)

The BBC and IBM PC's are the most popular micros in the UK. The BBC is firmly established in the education sector and the IBM is the industry standard in the business world. The pools of information and applications held on these computers are immense, yet the means of passing information between them are very limited. Beeb DOS provides a practical method of transferring information between these two micros.

Beeb DOS is a collection of utilities which run on the PC's and enable it to read and write information on BBC discs. You can transfer files between your PC's 360K floppy, high density floppy or hard disc and your BBC discs. In addition Beeb DOS allows you to catalogue, format and compact BBC discs and delete, re-name, lock and unlock BBC files, all on PC's. Each Beeb DOS utility is written in IBM assembler and is run directly from PC or MS-DOS. The Beeb DOS utility can be run from floppy disc, hard disc or RAM drive.

Beeb DOS is supplied on an IBM 5.25", 360K disc complete with a comprehensive operating manual. (Will only work on 360K Disk Drives & read only ADFS and Watford DDFS – not DFS).

Price: £39

(Please write in for technical literature)

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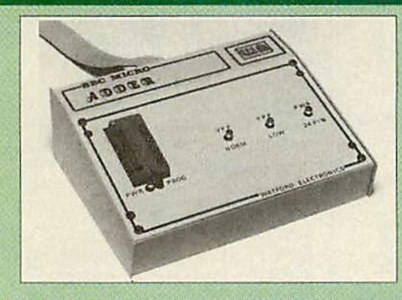
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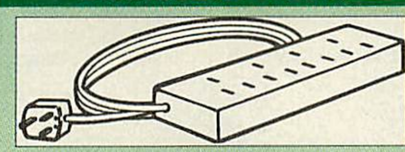
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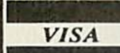
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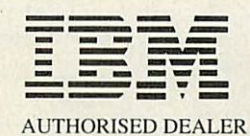


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LISSAJOUS FIGURES

B B M C E A Lissajous figures – the fascinating curves produced on oscilloscopes – take a step into the third dimension with *3DLiss* (Info1a) from **Michael Attenborough** of Liverpool. Methods of displaying lissajous figures using computers were first broached in *BAU* by Michael St Aubyn with his now famous Maths-in-Motion listing in November 1985 (re-printed in March of this year).

This original two-dimensional version worked by varying Cartesian co-ordinates (x,y) sinusoidally. The remarkable figures are created because of 'phase differences' between x and y.

The easiest way to express a point on the 2D curve is as (Rsin(At),Rcos(Bt+c)). A and B are constants which determine the 'phase' of the curve. The 'parametric' value t is varied from 0 to 360 degrees in order to plot the whole curve, and c is changed to give the appearance of rotation. R is simply a scaling factor.

Points in three-dimensional space clearly have three cartesian co-ordinates each (x,y,z). However, they can also be described using so-called 'polar' co-ordinates (A,B,r) where A and B are angles and r is the distance from the origin. Using this polar system, you can vary the angles A and B in much the same way as the 2D program varies its Cartesian co-ordinates x and y. The results are delightful lissajous figures that appear as the surface of a sphere.

(For more information about the theory have a look at the January 1991 issue of *Scientific American*.)

Having entered *3DLiss*, run it and experiment by changing the various parameters. The Z and X keys alter the value *A* and the C and V keys alter B. The ratio A:B – which determines the basic nature of the curve – is shown at the top left of the screen. You can rotate the curve using the up and down cursor keys and vary the speed of rotation with left and right. The shape of the curve can also be changed with B and N – these vary the angle C, shown top right.

You can also press 0 or 9 and change C to 0 degrees (at which the display is generally cone shaped) and 90 degrees (producing a sphere).

The best way to find out the possibilities is through experimentation though.

The machine-code routine at the heart of the program makes use of look-up tables and the Arm's multiply instructions to show the curve.

Most of the required parameters are passed to it from Basic as integer variables (A% and B% are the A and B of the equations for example).

Perspective is introduced by means of a look-up table. Having calculated the 3D co-ordinates of a point (x,y,z) these are converted to 2D. Such a conversion generally involves two of the co-ordinates being divided by a function of the remaining one. In fact, using the table per allows the division to be replaced by a multiplication and, as there is an Arm instruction to do this, it is much quicker. So you can see the effect of perspective, it can be switched on and off with the P key. A 'P' is displayed when perspective is active.

As we like to cater for both eight and 32-bit machines in ★INFO, we thought it would be nice to provide an eight-bit version of *3Dliss*. The result is *3Dliss8* (Info1b). The keys are the same for both versions so Beeb and Arc owners can experiment alike.

As you might imagine, producing an eight-bit version necessitated a few changes! The 32-bit program contained many multiplications and a couple of disguised divisions. Both these operations are very time consuming on eight-bit machines and so had to be replaced. The divisions required for perspective were costly in terms of processing time and so perspective is not used in the eight-bit version. However, the 3D effect is still strong since the motion is fast and smooth.

As for the remaining multiplications, a little schoolbook trigonometry comes to the rescue here (see figure 1). You have three angles a, b and c. The nature of the curve is determined by the ratio a:b and the angle c is the rotation of the curve as controlled by the up and down cursor keys. Converting these polar values to Cartesian form (x,y,z) you get equations (i), (ii) and (iii) where d is a plus some constant. You can throw away the x because this is only needed if perspective is used. When you add rotation in direction c you end up with (iv) and (v). Already there are quite a few multiplications involved, but you can simplify products of sin and cos using equations (vi) and (vii).

Thus one multiplication is replaced by several additions or subtractions – comparatively slower on an Arc with its MUL and MLA instructions but much more efficient on a Beeb. So, y can be calculated simply using (vii), and z with perspective added can be expanded to form the grand equation (viii).

For increased speed, the number of points used in *3DLiss8* is 256. On eight-bit machines, tables can be referred to much more quickly if they are no bigger than 256 bytes. Screen mode 4 is used rather than mode 0 – this takes up less memory and also means that each point is bigger, compensating somewhat for having fewer points.

The other major modification required to the eight-bit version comes about because you can't switch screen banks easily. On the Arc, two screens are used for smooth animation,

FIGURE 1

(i) $x = \sin(a)\cos(b)$

(ii) $y = \sin(a)\sin(b)$

(iii) $z = \sin(d)$

(iv) $y' = \sin(a)\sin(b)$

(v) $z' = x\sin(c) + z\cos(c) = \sin(a)\cos(b)\sin(c) + \sin(d)\cos(c)$

(vi) $\sin(a)\cos(b) = \dfrac{\sin(a+b) + \sin(a+b)}{2}$

(vii) $\sin(a)\sin(b) = \dfrac{\cos(a-b) - \cos(a+b)}{2}$

(viii) $z' = \dfrac{\cos(a+b+c) - \cos(a+b+c) + \cos(a-b-c) - \cos(a-b+c)}{4} + \dfrac{\sin(d+c) + \sin(d-c)}{2}$



but the eight-bit version has to remember the old position of each point and 'unplot' it before moving it on.

SORTING IT OUT

Sorting data is one of the key areas of computing. Databases, financial applications and even some games all need to maintain some semblance of order to the data they are dealing with. It will come as no surprise then that many years have been devoted to making sorting algorithms as efficient as possible in both execution time and memory usage.

Sorting algorithms are often compared in three ways: 1) the time taken to sort, 2) the number of comparisons made during the sort and 3) the number of 'moves' (loads and stores) executed during the sort. (2) is taken to mean the number of comparisons between items of data to sort only. Any other comparisons made, for example with the control variable of a loop, are ignored. The value of (3) must be increased whenever an access is made to an item of data. This includes accesses during direct compares of data 'in situ'. For example in the instruction:

```
IF a(x) < a(x+1)
```

two moves and one comparison are executed. Although quite rigorous, these three methods are rather stuffy and not always very easy to interpret. A far more interesting way to sort is to represent the data graphically and to animate the sorting process in some way. This will slow down the sorting time but will provide you with a nice visual representation of how the sorting algorithm works and may possibly give you some ideas as to how to improve its performance.

SortDemo (Info2a) on the yellow pages illustrates six quite different sorting methods in this way. It allows you to select the number of elements to sort (256, 128, 64 or 32) by pressing 1-4 and the sorting method by pressing A-F. An array is set up from 1 to, say, 64 which contains the numbers 1 to 64 in ascending order. The array is then 'unsorted' by swapping random elements. The data is represented graphically by plotting a point for each element, the x coordinate is derived from its position within the array, the y from the element's value. Sorted data therefore appears as a single diagonal line starting in the bottom left-hand corner of the screen. Unsorted data appears as widely scattered points. The dots are scaled so that they always exactly fill the screen, larger dots are therefore used for the smaller array sizes. 256 is the maximum number of dots as each element is then represented by a single pixel.

After jumbling the array, the appropriate sort routine is called to repair the damage. As the sorts progress, they update the dots on screen to mirror the status of data within the array.

FIGURE 3

a | b | c | d

The sort is thus complete when the screen once again shows a single diagonal line. The program keeps track of the number of comparisons and modes made by the sort and displays these values in a table after the sort has finished. The timing columns are only very approximate and can only really be used as a rough guide as large proportion of time in each sort is taken up by plotting the dots!

We ran the program on a BBC, an A3000 and an A440 with an Arm 3 with point sizes of 1 and 4 and the results are shown in figure 2 below.

Bubble Sort is an exceedingly 'stupid' sort. It steps through the array one element at a time comparing each with the next. If the next element is less than the current one they are swapped. This process is continued until a complete pass is made through the array without having to swap any elements at all.

In a **Sift Sort,** when an element is found to be out of place, the rest of the elements in the array are examined until a more suitable position is found. All the elements up to this point are shuffled and the original element is inserted into the newly created gap. Note this will not necessarily be its final resting place!

An **Exchange Sort** is the simplest sort to write that takes a reasonable amount of time to execute. It is also the most natural way for us humans to sort objects or data. For these reasons it can often be found within programs. Quite simply for an array of size n, n passes are made through the array starting at successive elements. On each pass the lowest element in the remainder of the array is found and swapped with the current element.

This sort is particularly good for small values of n, if you look in figure 2, you'll see it is actually faster than the infamous 'quick sort' with 32 elements. Implementations of quick sort often check to see how many elements it has to

FIGURE 2

Sort	Elements	Compares	Moves	BBC*	A3000*	Arm 3*
Bubble	256	61965	183430	1348.64	119.55	60.96
Sift	256	56874	88512	903.07	80.43	38.62
Exchange	256	32896	66816	206.17	14.19	3.55
Quick	256	3279	2777	60.82	5.23	2.81
Merge	256	3444	10980	93.06	8.44	4.91
Heap	256	3690	9138	108.16	9.81	5.67
Bubble	32	837	2502	25.81	2.20	1.24
Sift	32	1012	1548	20.56	1.74	0.96
Exchange	32	528	1184	6.37	0.50	0.23
Quick	32	294	231	6.87	0.57	0.32
Merge	32	244	810	9.75	0.90	0.53
Heap	32	267	673	12.07	1.11	0.66

* Timings in seconds



sort, and if there are only a few it uses an exchange sort rather than its usual recursive calls.

Quick Sort is a 'divide and conquer' algorithm. It uses the idea that sorting two arrays of size n/2 must be easier (and quicker) than sorting one array of size n. How does it sort these two smaller arrays? Simple! It just calls itself to split each into two n/4 arrays.

The actual sorting is performed during the splitting. A 'pivot' value is chosen, ideally a value close to the average of the data to be sorted.

The array is then ordered so values lower than this pivot are stored in the first half of the array and higher values in the second. Quick sort is then (recursively) called on each of these two new partially sorted sections. The main problem with quick sort is the time and memory overheads of using a recursive routine. It also not particularly good at sorting partially sorted data.

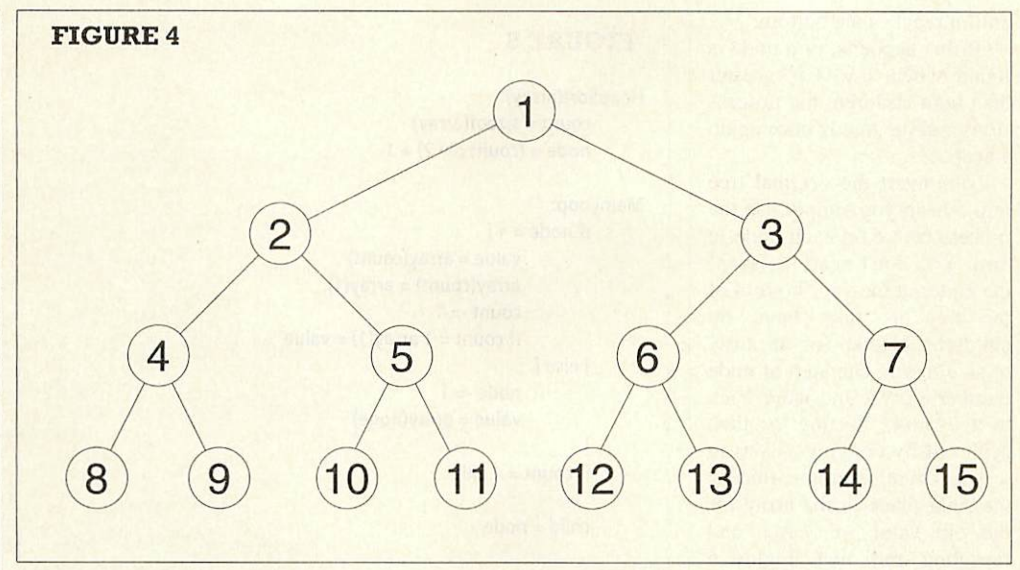
Merge Sort is another divide and conquer algorithm. The array is split in two and each half sorted (recursively) with merge sort.

The two sections are then recombined by maintaining a pointer for each section and, taking the lowest of the two current values, the relevant pointer is then moved on. Because of this merging process, merge sorting needs another array the same size as the data array in which to keep the other section of data.

Heap Sort is a sorting algorithm that works on binary trees rather than linear arrays. It may therefore not be immediately obvious how it can be made to work with arrays. There is, however, a very subtle way of doing what you want – more of this later! The heap sort employed by *SortDemo* is a version of the code used by Risc OS in the operating system routine OS_HeapSort. Before explaining how it works, you really need to understand the principles behind a 'true' heap sort working on a binary tree.

A binary tree consists of a number of nodes, each containing its value and, because it is a binary tree, two pointers to other nodes. These pointers may be null if there is no further node. A node is sometimes referred to as a parent and the two immediately connected nodes as its children.

FIGURE 4



Of course each child may have further nodes connected to it, creating grandchildren and so on – hence the tree analogy. Continuing this idea, the first node in a tree (or indeed, subtree) is usually called the root. The portion of a tree below a parent is often known as a subtree.

In a plain binary tree, there is no pattern to the nodes, and in this form the tree is not much use. Trees are therefore often ordered. In an ordered binary tree, all nodes in the left subtree of a node are less than its root which in turn is less than all the values in the right subtree. If data was in this form it would make sorting it relatively easy. However, it is not always a simple matter to get the data into this form and keep the tree balanced so that the sorting progresses as quickly as possible.

Another form of binary tree is a *heap* (we're getting there!) In a heap the value of a node is greater than all the values within the subtree taking the node as the root. Figures 3a and 3b show the numbers 4, 2, 1, 6, 5, 9 in the form of an arbitrary tree and heap respectively. Note that these are not the only possible tree and heap representations of this data!

Heap sorting involves taking a heap (eg, figure 3b), removing the root value as a sorted value, moving the rightmost value on the bottom row of the tree to the root (figure 3c) and converting the resultant tree back into a heap (figure 3d). This process is repeated until the heap is empty.

Finding the rightmost node is quite tricky. It involves finding out how large sub trees are and whether there are any 'hanging' nodes remaining. Converting a tree into a heap is a fairly straightforward task; the only hard think about heap sort is understanding how it works! Note that the data emerges from the sorting process in reverse order. This is not a problem, but just remember that it does.

Heaping (Info2b) is a program that demonstrates graphically how this process works. It prompts for 15 numbers to be entered which will be built into a binary tree. You may terminate the list with less than 15 by pressing RETURN after the last value. If you press RETURN immediately with no data entered, the computer will generate a random tree.

You can then sit back and watch the program sort the data. It will tell you what it's doing, as it displays the sorted data at the bottom of the screen as it makes it.

If you really want to appreciate how clever the array version of heap sort is, have a closer look at the appalling methods used to generate the tree, convert it into a heap and find the rightmost node in Heaping!

Sorting Arrays. The main problems in the tree version of heap sort are firstly, creating the tree with all its accompanying nodes and pointers and secondly, the recursive nature of the MakeHeap procedure. If these problems could be eliminated, heap sorting would be a very time and space efficient algorithm.

There is a very simple and, in fact, annoyingly obvious way of representing an array as a tree which does away with the need for using pointers. If you take a tree and number the nodes as in figure 4 and treat each node as an element within the array, then for any node x, its children are nodes 2x and 2x+1.

If you assume that this tree form of the array is actually a heap, then the value of array(1) is the highest in the array and so should be moved to the last element in the array. If, in fact, you swap these elements then no data will be lost but you will no longer have a heap. This means that you need to convert the array (excluding the 'last' element) back into a heap before repeating the above process.

What actually happens is, starting at the root, the old end value, lets call it newval, gets compared with the higher of the two children of the node: if it is less than this, the child is moved up to become the parent (you know it is greater than the other child) and the process iterates down the tree



until it reaches the bottom.

If this happens, or a node is found where newval is greater than both children, the process stops and the tree is once again a heap.

To convert the original tree into a heap you simply use the process above on each node in turn. You don't need to 'heap' the nodes at the very bottom of the tree as they have no children; instead, for an array of size n, you can start at node number n DIV 2 and work back to the root. Sorting is then achieved by copying array(1) to array(n), decrementing n, finding the right place in the array for the old value of array(n) and repeating until n=1. Figure 5 shows, in some arbitrary language, how OS_HeapSort implements this algorithm. The version used by SortDemo has been neatened up for Basic with the various GOTOs and such like removed or hidden!

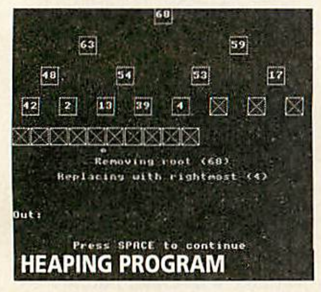

HEAPING PROGRAM

FIGURE 5

```
HeapSort(array):
      count = sizeof(array)
      node = (count div 2) + 1

MainLoop:
      if node = 1 [
                value = array(count)
                array(count) = array(1)
                count -= 1
                if count = 1 array(1) = value
      ] else [
                node -= 1
                value = array(node)
      ]
      if count = 1 exit

      child = node

SortLoop:
      parent = child
      child = child * 2
      if child > count goto HeapEnd
      if child < count [
                if array(child) less_than
                          array(child + 1) child += 1
      ]
      if value less_than array(child) [
                array(parent) = array(child)
                goto SortLoop
      ]

HeapEnd:
      array(parent) = value
      goto MainLoop
```

Note that there are no pointers, no recursion and, in fact, not even a subroutine call to create a heap. This is because the piece of code which initially heaps the data is also used by the main sort routine to replace the array(n) value.

If you are interested, the Risc OS OS_HeapSort routine is in the Utility Module starting at &0380A4C4 – follow it through at your own risk!

So eight-bit users aren't left out, listing *Heap8* (Info2c) is a 6502 implementation of the same algorithm. It has been set up to sort 256 two-byte values (to allow addresses to be sorted). A demonstration is included which generates 100 random text strings and sorts them alphabetically.

OS_Heap Sort. Readers of the PRM may know that OS_HeapSort can do a lot more than simply sort out numbers. Out of the seven parameters you can supply, *BAU* (Risc Revue) has only ever covered the first three, so read on for the whole gory story!

R0 contains the number of elements to sort pointed to by R1. These are four-byte (ie, word size) objects so will often have to be pointers to the 'real' objects. The top three bits of R1 have special meanings, more of which in a mo. R2 contains the address of a comparison routine or a number less than six for various special cases. These cover most of the usual uses for sorting, ie, an array of integers, or pointers to strings. However, you may need to sort say, a five-byte time reading, in which case it will be necessary to write a comparison routine and supply its address in R2. This routine will be called with R0 and R1 contains two elements from the array (don't forget they may be pointers!) which need to be compared. Your routine can corrupt R0-R3, but should return LT (ie, less than if 'R0' < 'R1'). If you wish you can pass a workspace pointer in R3. This will be passed in R12 to the comparison routine. This could useful if you are using OS_HeapSort in a module and want to have access to the module's RMA workspace. R3-R6 do not have to be specified, but are really very useful in certain applications.

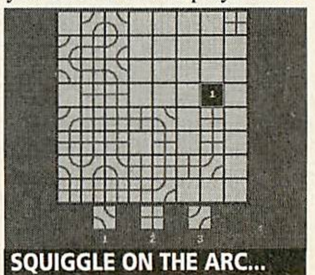
If you are sorting objects of a fixed size, but larger than four bytes you have to build a table of pointers to your objects. OS_HeapSort will do this for you if you tell it where the objects actually are (in R4), how big they are (in R5) and set bit 30 of R1. Unfortunately it can't automatically create a table of pointers to variable length objects! Bit 31 of R1 can be set if you want OS_HeapSort to physically re-order these objects in memory after sorting by using the now sorted pointers at R1.

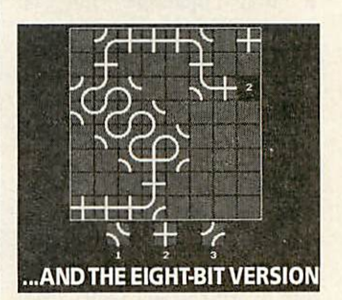
Due to internal memory limitations, if your objects are bigger than 16K, you'll need to set bit 29 of R1 and pass the address of a suitable area of memory large enough to hold one data object.

OS_Heapdemo (Info2d) is a demonstration program which sorts 64-bit numbers and makes use of these extended features (except R6). The machine code at .compare simply compares the two words of the 64-bit number. The rather contrived BIC and ORR instructions are needed because the numbers are unsigned, and CMP doesn't quite return the correct bits set for the LT condition to work.

SQUIGGLE GAME

B B M C E A — *BAU* regular **Barry Wickett** has supplied a little game for the Archimedes. It's called *Squiggle* (Info3a). There is a version for eight-bit machines called *Squig8* (Info3b). The idea of this two-player game is to make a path connecting the bottom left square of the board with the top right. Achieving this wins the game, but if you divert the path off the edge of the board you lose. The two players take turns in placing a piece on the board at the square indicated. You have a choice of the three styles shown at the bottom – press 1, 2 or 3 to select. Once you have laid a piece the computer will follow the new


SQUIGGLE ON THE ARC...


...AND THE EIGHT-BIT VERSION



section of path made and then ask the other player to make a move.

The program is quite simple to follow. The board is stored in the array board%() and the variable pd% contains which side of the current square the path entered. When a new tile is laid, values are looked up in the arrays ix%(), iy%() and entrance() to find out where the path goes to next. A REPEAT...UNTIL loop is used to trace the path until it finds a blank square. If this is the top right square, or off the board the game is over.

The eight-bit version is similar to the Arc program, the only major differences relating to the display.

There is no circle-plotting facility on the Beeb so the curved pieces are drawn with user-defined characters, read in from DATA statements at the end. Rectangle plotting and filling is done by special procedures.

If you master the game and are feeling adventurous why not try adapting the program so you can play against the computer or get it to play itself? We'd be delighted to publish a good computer-play version in ★INFO.

PIC-LIST UPDATE

We are grateful to **Dr Chris Corbett** who pointed out a possible cause of error in Chris Ruseman's *Pic-List* application in the May 1991 issue of *BAU* (page 80). It seems that drawfiles can have bounding boxes with one dimension zero. For example, a single thin vertical line produced in *Draw* is saved with zero width and this causes a 'division by zero' error which actually shows up in *Pic-List* as 'Bad colour translation'. The solution is to add the following two lines:

```
6845 IF rwidth=0
THEN
rwidth=1
6855 IF rheight=0
THEN
rheight=1
```

Another problem has come to light regarding the display of sprites with their own palettes. Chris points out that palettes as stored in sprites consist of eight bytes per colour (presumably so that images may be stored with specific flashing colours). When creating colour translation tables though, palettes are required to have only four bytes per colour and this results in *ScreenSaved mode 0 sprites appearing as plain black in *Pic-List*! The solution is to change/add the following lines:

```
6380 IF
saddr%!32<>44 THEN
6381 FOR i%=0 TO
saddr%!32-45 STEP 8
6382 buffer%!(i%/2)
=saddr%!(i%+44)
6383 NEXT
6384 spal%=buffer%
6385 ELSE
6386 spal%=FNwpal
(spmode%)
6387 ENDIF
```

You should also change the version number at line 4770 from 0.90 to 0.91 and the date to May 2 1991.

SYSTEM SPRITES

Graham Hick of Marlborough has asked how it is possible to customise the system sprites on the Arc, having noticed in a screen-shot that the A logo on the icon bar was different. Well, it's pretty easy to alter the standard sprites in this way. All you need to ensure is that your new versions have the same name and are the same size.

Risc OS sprites are stored in two groups. One set is in Rom and here you will find the standard Archimedes logo, disc-drive icons and so on.

Another set can be found in Ram and it is here you will find the sprites loaded by applications using the *IconSprites command. These are the various icons for applications themselves along with any associated file type icons.

You can replace any of the Rom sprites by loading a Ram sprite with the same name. Perhaps the easiest way is to add the desired new sprites to the Sprites file in your System directory.

So you can have a look at the system sprites in more detail, try running *GrabSpr* (Info4). This will save the Rom and Ram sprites as two files so you can load them into *Paint* and observe the correct sprite names and dimensions. It uses the operating system call "Wimp_BaseOfSprites". This returns the start address of the Rom sprites in R0 and the Ram sprites in R1

One point to note is that replacement sprites will only appear when the screen is redrawn. Hence, it may be best to run a Boot file from Basic which loads the new sprites using the *IconSprites command and then enters the desktop.

OOPS!

Apologies must go to **Dr John Barker** whose contribution to Eight Bits – one of the precursors to ★INFO – was 'mangled' slightly before publication! Any reader wishing to modify his 24-pin colour printing program to work with nine-bit printers should note that the relevant part of the instructions (page 58 of the April issue) ought to have read as follows:

'Lines 1240-1270 are deleted so each byte is printed once only. The code for moving to a different colour on the ribbon at line 500 is ignored by the monochrome printer, and need not be removed.'

★QUIT

Well, we've come to the end of the first ever ★INFO. We hope that eight-bit and 32-bit users have all found something of interest, of use or indeed, of both. If you have an item to contribute, be it program, hint, tip or simply an idea, do write in to ★INFO at the address below. Any comments, suggestions or even complaints are all equally welcome, so if this column does not reach you in perfect condition do let us know – your statutory rights will not be affected!

Programs, aside from the very shortest, should be sent on disc together with sufficient explanation of how they are to be used and how they work. Where possible we will supply BBC/Master versions of Arc submissions and vice versa.

Of course, if your program works on the whole range of machines then so much the better. Graphical items are particularly popular with readers, but there are really no limits. Any submissions too long to carry as listings in the yellow pages may find a home on the monthly disc, so don't despair if you've written some 2000 line masterpiece that you'd like to share with the discerning *BAU* readership!

So, if you've come up with something good and you can't keep it to yourself any longer, you know what to do – put it in a Jiffy bag and send it to us!

Till next month then, thank you for reading and happy key-tapping!

Dave Lawrence
Dave Acton

Submissions to ★INFO should be sent to us at: *BBC Acorn User*, Redwood Publishing, 20-26 Brunswick Place, London N1 6DJ. If you enclose a stamped address envelope it will ensure a speedier reply and return of your disc(s).

COMPATIBILITY KEY

- B — BBC B compatible
- B+ — BBC B+ compatible
- M — Master compatible
- C — Master Compact compatible
- E — Electron compatible
- A — Archimedes compatible
- BBC A3000 compatible

★INFO COMPATIBILITY TABLE

	BBC B	Master	Electron	Arc
Info1a (3dLiss)				★
Info1b (3dLiss8)	★	★	★	
Info2a (Sort Demo)	★	★	★	★
Info2b (Heaping)	★	★	★	★
Info2c (Heaping8)	★	★	★	
Info2d (Os Heap Demo)				★
Info3a (Squiggle32)				★
Info3b (Squiggle8)	★	★	★	★

GAME PLAN

No-one to play with? You could always challenge your Archimedes to a game! **DAVE ACTON** explains how it's possible

The idea of getting computers to play and even beat humans at games of strategy has been popular with programmers for many years. Perhaps the motivation is the same gentle obsession that affects train-spotters, or maybe it's a more sinister 'Frankenstein' complex that possesses them – a desire to create a thinking 'being'. It's really anyone's guess.

Getting a computer to play a simple game such as noughts and crosses is not too tricky. There are tried and trusted methods of searching through the list of possible moves in order to find the best. And in simple games this list of possibilities may well be small enough for the computer to stand a good chance of winning a game or two! Still, it can be a fiddly process writing 'thinking' programs. They are unavoidably recursive by nature (that is, a program examining a set of possible moves may 'use itself' to look one level deeper). It occurred to me that it might be useful to have a single module to take the hard work out of getting the computer to play and that could be used for a variety of strategic games. The result has become known as *GameCore* and this article is about how it works and how it is used. An example of *GameCore* in action is provided in the shape of 3D noughts and crosses.

THE THINKING MACHINE

There are two commonly known approaches to the task of getting machines to play games. The first employs the so-called 'heuristic search'. This method really belongs in the realms of artificial intelligence and, although it has had some success in chess-playing programs and shows great promise, is currently somewhat in its infancy.

The second, older and simpler approach is employed by most commercial strategic games programs and is also used by *GameCore*. The idea is to go through the 'tree' of possible moves – looking at every option open to you and, for every one of these, every reply your opponent may make. And of course, to each of these replies there is a set of responses that you can make in turn! So the search goes on, trying out moves and counter-moves until a specified 'depth' of search is reached.


RED WINS IN 3D...


...BUT WHITE SCORES BACK!

At this point you have to count up the values for each of the possibilities you've looked at and find the best.

The process of finding best moves by looking through trees like this is often called minimaxing (from minimising and maximising) and is illustrated by figure 1.

Imagine you are playing a game – draughts say – and there are three possible moves that you can make next turn. Your current position is Root in the diagram and the three moves available take you to new positions A, B and C. Because you're looking for the best move, you'll try out in your mind each of A, B and C and make a note of their values (based on how many pieces are taken, how well positioned the remaining pieces are, etc) The highest scoring move is the one to make. But your opponent is also trying to make the best move they can.

Consider move A. There are three responses to this: D, E and F. The values of the position after these moves are 9, 4 and 6 respectively. Your opponent will play E because this is the worst move for you. Hence the minimum at A is 4. Similar minimums are calculated for B and C. At the root you are looking for the maximum value, so C is chosen. Even if your opponent plays the nastiest move in reply you will not end up in a worse position than value 7.

A problem with tree searches is scale. It has been estimated that an average of 38 moves are available each turn in chess. To look 10 half-moves ahead would require trying out 38^10 positions – over six thousand million million of them! It's no wonder methods x of pruning the move tree have been sought and the best known – alpha-beta pruning – is used by *GameCore*.

SAFE PRUNING

The advantage of alpha-beta pruning is that it's safe. All valid possibilities are explored and the best move, even if it appears to be a bad move at first glance, will always be found.

The alpha part of the process is shown by figure 2. First, move A is tried with all the possible replies D-F. This produces a minimum value at A of 4. Next B is looked at. The first response is G which makes the minimum-so-far (or minsofar) value 2. Because the opponent always looks for minimum value, the 2 at B can only get lower, so will never be bigger than the 2 at A. We can thus prune off H and I with complete confidence!

Beta pruning works similarly but at the other end of things. Figure 3 shows another move tree. Firstly, move A is tried with all its responses, C to E. A further level is considered – moves F to

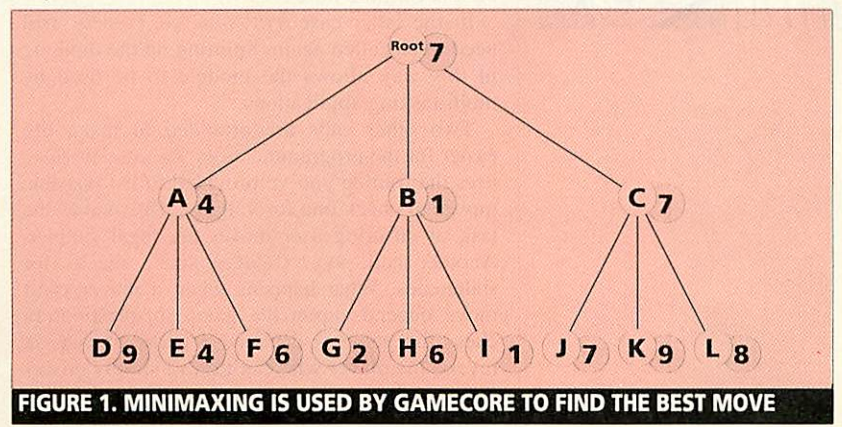


FIGURE 1. MINIMAXING IS USED BY GAMECORE TO FIND THE BEST MOVE

N. At C you are looking for the best reply in response to your opponents move C. G is chosen and so the maxsofar at C is 4. After trying D you achieve a maxsofar of 9 by the time you get to J. Here there is no point in even looking at K – the maxsofar at D is already 9 and will only get bigger. Thus it will never fall below the minsofar of 4 you had at C, therefore you can prune K off.

Alpha-beta pruning dramatically cuts the number of moves that need to be examined and is vital to *GameCore* and every good chess program. Ironically, it is most efficient when the order in which moves are looked at runs from best to worst. Clearly though, you don't know the best until you've worked it out!

You can, however, pre-sort moves according to either guesswork or a shallow lookahead which involves a preliminary tree search of fewer levels than the main one.

The idea is to order the moves as best you can before looking at them. Sometimes the best of all will be disguised and may not be looked at until quite late on in the search. Mostly though, providing your lookahead is sound, you will spot the best moves in your preliminary search and in these cases the thinking procedure is sped up considerably by the improved pruning rate.

USING GAMECORE

And so we come to *GameCore* itself. What is it? Well, it takes the form of a relocatable module that provides a set of SYS calls that can be used by Basic and other programs. To write a new game you simply provide the routines specific to that game (to list possible moves, make them, unmake them and so on) and *GameCore* does the rest.

The module has been designed for use in the desktop environment. It can think in short time slices, so you can use it to play games while other tasks are active.

The desktop side of things deserves explanation in its own right, so I'll be covering it next month. I'll also be providing a full Risc OS application that allows simultaneous play of different board games in the desktop. As a taster though, I've included a single-tasking demonstration this month. You'll find all the necessary listings on the yellow pages.

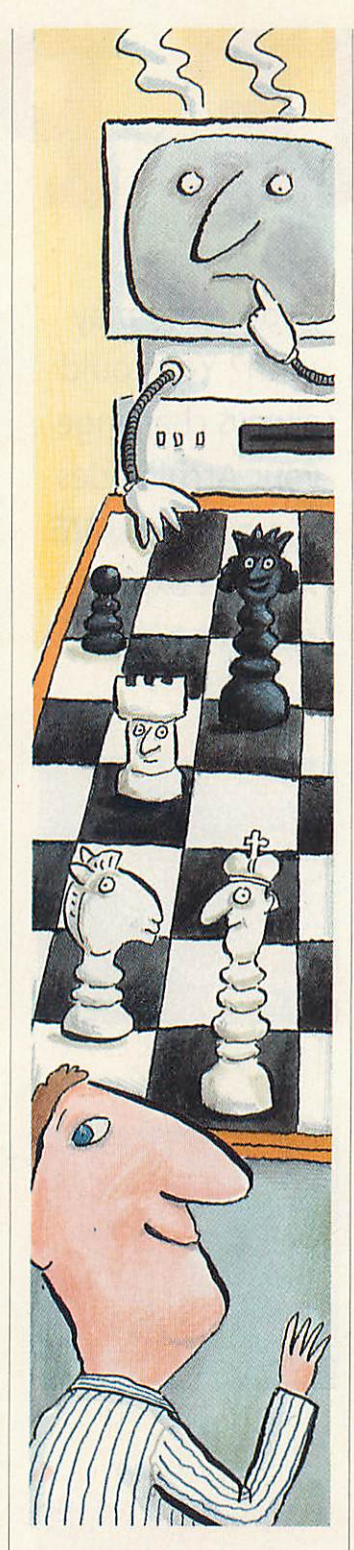
You will need to create a directory called !GameCore. In this you should save listing 1 as !RunImage. You should then create an obey file using *Edit* and save it as !Run in !GameCore. It should contain these lines:

```
Set GameCore$Dir <obey$dir>
<GameCore$Dir>.!RunImage
```

Next enter and run listing 2. This assembles the thinking module and saves it as GameCore. Ensure this module is also in !GameCore. Finally, save listing 3 as TD in the directory.

This is the 3D noughts and crosses library and contains all the necessary routines to play the game. This Basic program will be used next month by the full Risc OS application and I'll also be supplying another game in the same form.

Finally, to run the demonstration, click on !GameCore from the desktop. You will be supplied with a 3D noughts and crosses board. Click on the arrows to rotate the board and on



2D-3D to change the view as you like. To make a move simply click on a blank square.

You play as white and the computer as red. To win the game you just need to get a row of four in any direction – horizontally, vertically or diagonally. Rows running vertically or diagonally through all four levels also win. Because the game is just a single-tasking demo, the front-end has been kept to a minimum. If you can't wait until the full desktop version next month, do play about with some of the variables in !RunImage. The array control() contains 0 or 1 for each player depending on whether they are computer or human. Set both control(0) and control(1) to zero to watch your Arc play itself. You might also like to alter the time allowed per move – stored in timepermove(). The program tries to intelligently manage the time available for a move. A quick 'desperation' search is made at a low depth and then progressively deeper and deeper searches are made until the next level up is expected to take too long.

Occasionally, longer than the allotted time will be taken if it is thought that a valuable deeper search can be completed.

HOW IT WORKS

Next month we will look in more detail at how *GameCore* works and how to write your own game using it. This month I'll list the calls it provides and look briefly at how the game libraries work.

GameCore, like many modules on the Arc, provides a range of routines that are called with SYS. The first call used by !RunImage is SYS "GameCore_Init" which takes a pointer to an information block. This block of 128 bytes contains details about how your game works – where the board is in memory, how many bytes it takes to store a move and so on. In 3D noughts and crosses you can see the info block being built in FNtd_init.

Having described your game to *GameCore* it provides you with a handle. Using this you may ask it to find the best move for a given player in a given game position.

Two SYS calls are provided – SYS "GameCore_Think" which starts the process off and SYS "GameCore_Continue" which is called however many times is necessary to find the best move. Both calls take as their second parameter (R1) a duration in centiseconds. This is how long you want the module to think for. It will return after the specified time and say 'I've found a move' or 'I need more time'.

In the latter case SYS "GameCore_Continue" will need to be called again. Splitting up the thinking in this way allows the module to be used by multi-tasking applications.

Two other calls are provided to make life easier for the programmer. SYS "GameCore_Validate" uses the routine you've provided to list possible moves to check one for validity. This makes the task of ensuring user moves are legal simpler. Another call, SYS "GameCore_Stale", checks for stalemates. What happens when a player can't move depends upon the game in question. In chess the game is declared a draw whereas in reversi the player who can't move simply misses a turn. A byte in the information block supplied to *GameCore* describes what you should do

when no valid moves can be found.

Each game has its own library of routines, loaded by !RunImage using Basic's LIBRARY command. These should all be functions and procedures with names prefixed appropriately. In TD each function name begins td_ and among them are some special ones that must be provided by all game libraries. FNtd_getmove is provided with button clicks from the user and is asked to return details of any valid move made with those clicks. FNtd_initdomove and FNtd_domove are used to physically make a move, including any animation. Like the other functions, these are passed a single parameter by !RunImage. This is the address of the information block first set up by the program. This block contains not only information about the nature of the particular game but also whose turn it is, what mouse buttons have been pressed and so on.

Some bytes are used by specific libraries for their own purposes. For example, TD stores either 0 or 1 in byte 92 of the information block depending on whether a perspective view is selected. By keeping the link between !RunImage and the TD library down to this single block you prepare yourself for the multi-tasking environment and the possibility of a single calling program running several games simultaneously using different libraries.

To further simplify this link, each game has its own sprite and before any of its library routines are called, VDU output is redirected to that sprite. If the library changes any part of its own display (for example, if a square is highlighted before being moved to) this is detected by the main program !RunImage and the appropriate area of the private sprite is replotted on the screen. (The handy call OS_ChangedBox enables you to do this, but there'll be more detail on that next month!)

!RunImage simulates a multi-tasking program and uses flags wherever possible to keep track of what's going on. For each game (there are potentially 8 loadable at once although only game 0 is used this month) there is a status byte. This contains one of five status values:

0 I am about to think
1 I am thinking
2 I have thought of a move and am about to do it
3 I am making my move
4 I have finished moving – prepare for the next one

Generally the status moves on from 0 to 4 in sequence and then back to 0 again, although there may be a jump from 0 to 4 if a player has no valid moves available.

As a final note it is worth giving an inkling into the strategy used by the computer when playing 3D noughts and crosses. Weight is clearly given to winning lines of four and indeed, the longer the line made the more it scores. Points are also scored for blocking opposing lines however.

The computer can often be seen vacillating between following its own strategy and blocking yours. It will also favour forcing you to make lines of three so it can block them. Initially this was seen as a weakness in its play but I now think it might be an advantage – exhausting the opponent's potential threats before they become real. Positional values are also included. PROCtd_makemap builds a table which gives weight to the most useful squares, notably the corner ones on the top and bottom layers and the central ones in the middle layers. These can be used in lines in seven possible directions and so should generally be grabbed towards the beginning of the game to strengthen your position in the later stages.

With these strategies in mind you might be able to work out how best to beat the machine. If you still find it hard to outsmart your Arc though there is of course still one option. Just write a program that plays even better...

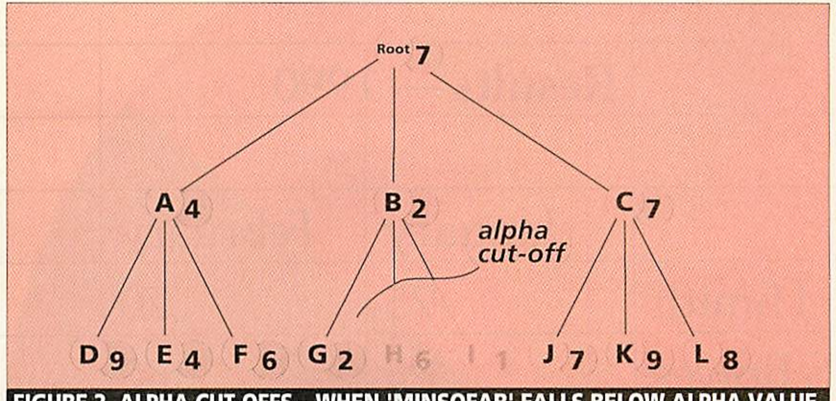


FIGURE 2. ALPHA CUT-OFFS – WHEN 'MINSOFAR' FALLS BELOW ALPHA VALUE

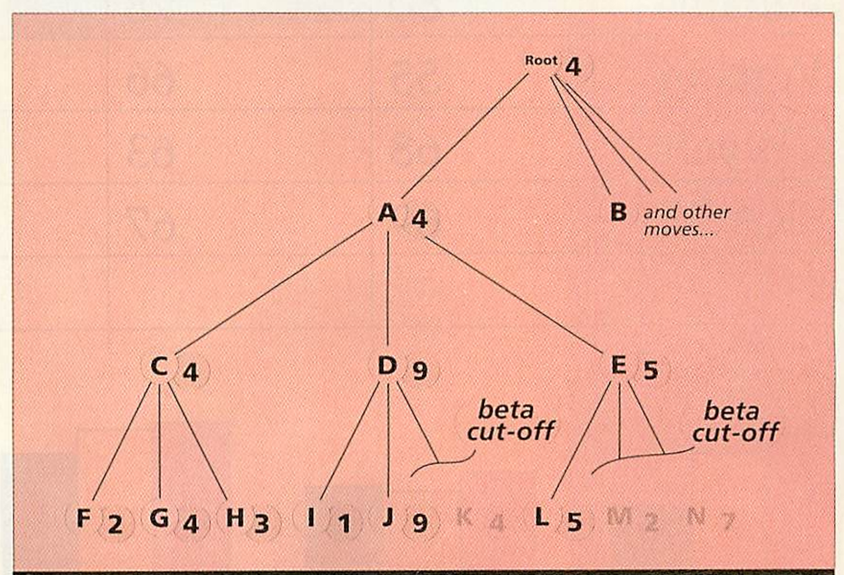


FIGURE 3. BETA CUT-OFFS – WHEN 'MAXSOFAR' IS BIGGER THAN BETA VALUE

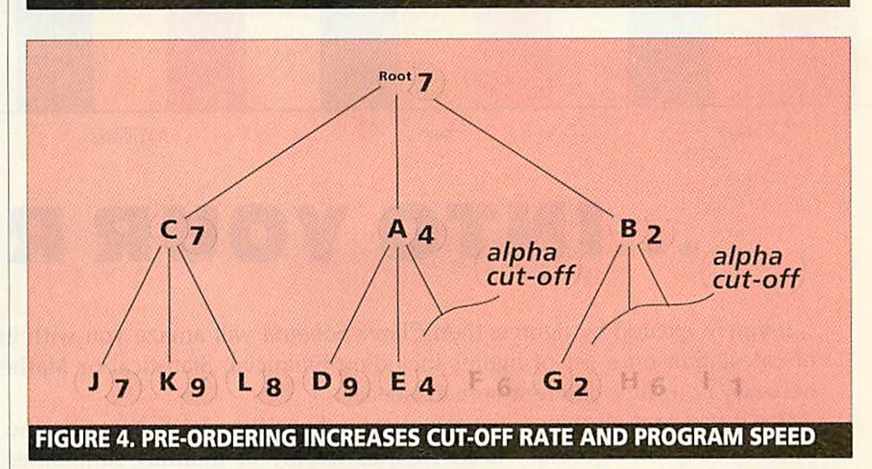


FIGURE 4. PRE-ORDERING INCREASES CUT-OFF RATE AND PROGRAM SPEED

PUT SOME COLOUR BACK...

Results — 1990	January	February	March		
J Smith	75	70	55		
S Bowes	65	60	61		
A Williams	80	78	71		
S Watson	55	66	55		
R Wyatt	68	63	56		
AVERAGE	69	67	60	67	6
				Overall Average	6

80
70
60
50
40
30
20
10
0

J Smith S Bowes A Williams S Watson R Wyatt

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Schema runs on all Archimedes and BBC A3000 computers with at least 1 Mb of memory and RISC OS.

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SNEAK PREVIEW

DAVE LAWRENCE has come up with a program for previewing Beeb screens

In the May issue of *BAU*, we published three of the best extensions to *View* that have appeared in the magazine over the years. I would now like to present *PreView*, a screen previewer which acts as a replacement for the SCREEN command, but is also capable of interpreting the various highlight commands that *View* can handle.

It is loaded as a printer driver with the PRINTER command in the usual way and summoned into action when the text is PRINTED. This may not sound very revolutionary, but as far as I know, *PreView* is the only highlight previewer that can cope with normal and extended highlights, underline, bold, italic, superscript *and* subscript, all within the allowed 256 bytes! It can also detect 'illegal' highlights. Other similar drivers may offer some of these, but invariably they will load fonts off disc, or make use of sideways Rom or Ram.

I've had to use some fairly horrible programming techniques to squeeze this in, including using some zero page locations &90-&9F. This means that the program may not work on Econet, but if anyone knows of any zero page locations available to the user when *View* is running, I'd be very interested to know. I also use locations &F8 and &F9, but according to the *Advanced User Guide*, these are unused by OS 1.2, so I think I'm fairly safe here.

USING THE PROGRAM

Type in the source code PVsrce and save and run it – this will assemble the code and perform a simple checksum. If all is well, it will save a file called *PreView*. Now enter *View* with *WORD and type PRINTER PREVIEW. Typing SCREEN will display the text formatted, but with the highlight commands still displayed as * and -. Typing PRINT will display the formatted text, but will also translate the highlights into various on-screen effects.

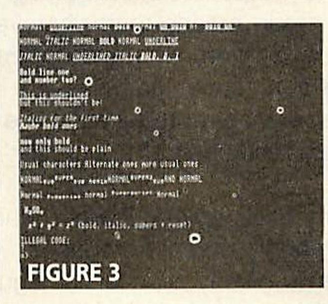
PreView can handle both normal and extended highlights. Normal highlights allow only underlined and bold characters (highlight 1 and 2 respectively). Extended highlights include these, but also allow italics, super- and subscript and an alternate character set. A printer reset code is also included.

To use extended highlights you need to change the code generated by highlight 2. This is achieved simply by including the *View* command HT 2 130 at the start of your text – you can then use the various combinations of highlights shown in figure 1 to generate the desired effects.

*---	Reset printer
-	Toggle underline
***	Toggle bold
*-	Start subscript
**	Start superscript
**-	Revert to full text
*--	Toggle alternate
-	Toggle italics

FIGURE 1

FIGURE 2


FIGURE 3

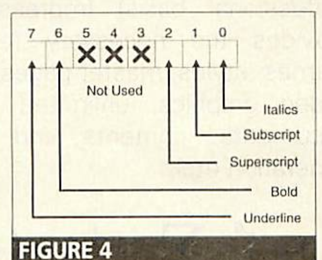


FIGURE 4

You do not need to tell *PreView* which sort of highlights you are using, since it can tell automatically from the Ascii codes. Due to lack of memory (15 bytes to be precise), I was not able to put in any screen effect for the alternate character set highlight. This is normally set to produce pica-sized text on the printer. If an illegal highlight is inserted in the text, eg, *-*-*, *PreView* will generate an error and return to *View* command mode. Again, due to lack of space, this error is simply a '?'. Figure 2 is a screen shot of *View* edit mode and shows a 'test' document which demonstrates all the features of *PreView*. If you type this in and preview it, you should end up with the display in figure 3.

As with all printer drivers, *PreView* needs to be loaded at &400 and can only be one page, ie, 256 bytes long. The first 15 bytes consist of three JMPs to routines within the rest of the code – *PreView* only uses the first two.

These are print character and initialise and call the two routines .writec and .init respectively. The other entry points are not used and begin with an RTS. Note that the label .nostyle actually appears half way through an entry point – there is nothing wrong with this, it just saves one byte in the initialisation routine!

The main part of the program starts at .writec which is called with a character in A. This is either an Ascii character or &80 for highlight 1, &81 for a non-extended highlight 2 and &82 for an extended one. These special values are checked for first – &81 always means bold, &82 is always extended, but &80 may mean non-extended underline or it may be part of an extended sequence. The location 'extended' is used to keep track of extended highlight sequence. If the top bit is clear then you are not in a sequence. If it is not clear, then the values &80 and &82 are converted into 0 and 1 respectively and inserted at the start of extended. The code for this can be seen at .extend.

When an 'ordinary' Ascii character is to be printed, the value of extended is first checked to see if an extended sequence needs to be dealt with (starting at .plain). If it does, the top bit is cleared and the bottom bits are treated as a 'highlight number'.

This can be visualised by taking the highlight sequence, representing * as 1 and - as 0 and treating the result as a binary number.

Some self-modifying code comes next which extracts a branch from the table at .btable for the highlight number. The modified branch at .branch is a BNE so that entries of 0 (an illegal highlight) will simple fall into the error generator. The location style contains a bit pattern which represents the highlights 'on' at any time.

These branches jump to small routines which simply modify this bit pattern and thus change the style of printing on the screen. Figure 4 shows the layout of the STYLE byte.

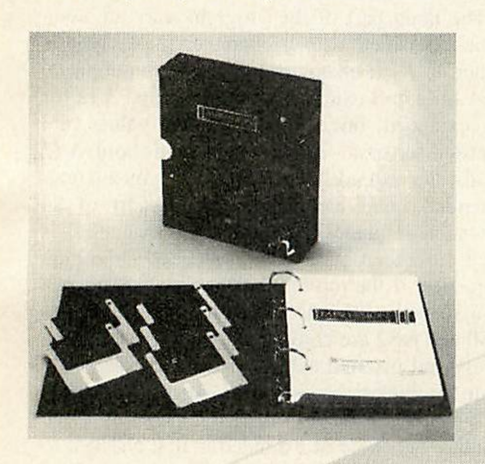
When a 'real' character is printed, its definition is read (with OSWORD 10), the various bits in style are tested and the appropriate bit twiddling routines used to modify the definition. These can be found starting at .realchar.

Finally, this new definition is used to define character 128 which is then printed on the screen. A fully commented listing can be found on the *BAU* monthly disc.

Impression is not

Well OK, that's not true. Although Impression has established itself as the most popular DTP program (and the most flexible) for the Archimedes, it may be surprising to learn that most owners use it day in, day out as their preferred word processor.

Impression was in fact designed from the start to be a word processor, by the company that developed Wordwise and Inter-Word, the most popular word processors on the BBC Micro. However Impression now uses the power and flexibility of the Archimedes to take word processing beyond what was possible on the original BBC Micro while losing nothing of the ease and simplicity of its predecessors.



" Easier to use than Wordwise " . Well certainly no more difficult. For example to create and print a simple letter, even one many pages long, involves the following simple steps, (assuming a printer is set up and ready).

- Start Impression
- Click on icon for new document
- Click in window and type letter
- Press PRINT key followed by RETURN

There are no embedded commands to remember and it's not even necessary to use any menu options. If you want to use different text styles or justification options, these can be selected from the function keys (or menus). Selecting regions of text (for deleting, copying, moving etc) could not be easier than with the mouse, especially since we added such touches as automatic scrolling of the window when attempting to select beyond the visible window.

So not only do we feel Impression is easier to use than other word processors, it is also more powerful - not only can it handle more complex documents, it copes with much longer documents and provides unmatched control of the presentation and appearance of the finished document. By using the Acorn outline font system Impression offers complete control of type style and size - the type on screen exactly matches the final printed result.

One feature that sets Impression apart from other DTP programs is that it offers both the outline fonts system *and* a system-like font for simple 'character' mode or draft mode operation. This also means it can drive dot-matrix printers using their native built-in fonts for maximum speed. Of course using the RISC OS printer drivers in high quality mode means that whatever you do on screen, whatever fonts, size, position, style, graphics are used, they will be reproduced at the maximum resolution of the printer.

For the power user (that is someone who produces documents of any type on a regular or professional basis) Impression II provides the necessary features (frames, styles, master pages, embedded graphics, unlimited length documents, contents and index generation etc).

$$J_n(x) = \frac{x^n}{2^n n!} \sum_{s=0}^{\infty} \frac{1}{s!(n+1)^s} \left(-\frac{1}{4}x^2\right)^s$$

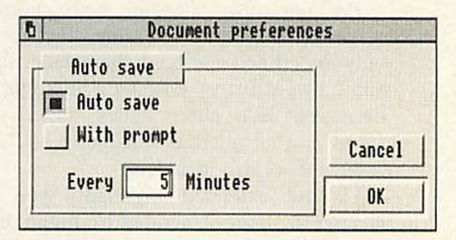
New!

Version 2.1 is now available. It includes automatic timed save, crop- mark printing, vertical rules for things like tables and sidebars, and other new features. Contact Computer Concepts for upgrade details.

When used with our highly acclaimed Equasor equation generator program (£49+VAT) Impression is the ideal tool for producing technical or mathematical documents.

> In order to highlight particular sections of text Impression 2.1 allows sidebars, such as the one used here, to be set as part of the style. The vertical position, thickness and colour can all be controlled from the style editor.

But rather than the more obvious and powerful features, it's the subtle and often overlooked aspects of Impression that make it a delight to use - its speed of operation; the fact that most dialogues can stay on screen while you continue to edit; the care and attention paid to the visual side of the program. Even though the program is now more than a year old it continues to receive glowing reviews.



Impression 2.1 can automatically save your document every 'n' minutes, with options to do this with or without prompting.

a DTP program !

To quote Paul Beverley, editor of Archive magazine. *"Thanks to Impression (which I am more and more impressed with every day) I have managed to shorten the time taken to produce the magazine quite considerably."*

Although Impression is a word processor, what other word processor, or for that matter DTP program, is able to produce results like this advert.

Impression 2.1 ...... £169.00 +VAT (£198.57)

Impression Junior ... £89.95 +VAT (£105.69)

Beyond other WP's

Impression and Impression Junior offer many features beyond those normally found on Archimedes word processors. Here are just a few:

- **Format as you type - no reformat key or menu**
- **Outline fonts, any size, any typestyle, any position on the page**
- **Multi-column work**
- **Text automatically flows around graphics**
- **Full graphics capabilities**
- **Embedded graphics (flows with the text)***
- **Simple, intuitive editing with a wide range of key short-cuts**
- **Retroactive styles and master pages***
- **Fine typographic control - kerning, text size, line & paragraph spacing etc to a 72,000 dpi resolution***
- **Rules for sidebars, rule-offs, tables***
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- **Multi-line headers/footers even with graphics**
- **Draft 'character' mode printing or RISC OS printing**
- **Full colour control**
- **Includes enhanced version of SpellMaster, the popular BBC spelling and typing checker**

*Not all of these features are available on Impression Junior

Impression business supplement

This optional extension pack provides a range of new features for the professional or business user. It includes:

- A new range of file loaders for Microsoft Word (RTF), Word Perfect, Wordstar and Pipedream 3 allowing files from these word processors to be dropped directly onto Impression frames.
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- Full (four) colour separations. So now at last Archimedes owners can output four colour PostScript separations from any Impression document. Essential for anyone producing high quality colour leaflets or adverts. This offers advanced features such as under-colour removal and Adobe recommended screen angles.
- Mail merge program and record sorter utility. Allows simple multi-field records to be seamlessly merged into Impression documents.

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IAN BURLEY looks at terminal emulation, how data is formatted in a comms link and explains how to get on-line for as little as £20

LINING UP

To get your first taste of comms, you need to use your computer as a 'dumb terminal' – ie, one that displays (and even scrolls) text. In this article, I have included a BBC Basic listing for a very simple dumb terminal emulation which will run on either a Beeb or an Archimedes.

The fact that the program is not particularly efficient (it isn't very usable at speeds in excess of 300 bits per second) is not important – it has been written to demonstrate what is involved in transmitting characters you type into the keyboard via the serial port to another computer. The program also takes incoming characters from the serial port and displays them on the screen.

Quite simply, there is a loop which alternatively listens for characters from the keyboard and serial port and, once one is trapped, displays it on the screen or sends it out to the serial port. BBC Basic's VDU command sends characters to destinations like the screen or serial port as determined by *FX2 and *FX3. In fact, it is very easy to write terminal programs in BBC Basic and commercial comms programs written largely in this language are very common.

The loop has to be quite fast. If your terminal is set to 300bps, your program must be fast enough to catch at least 60 characters per second (30 travelling in each direction). Although Ascii characters are defined as eight-bit values, it is safer to assume characters transmitted using most affordable modems are 10 bits long. Data is made up of eight-bit bytes but data transmissions are just serial streams of bits – 1s and 0s.

When data bytes are presented to an asynchronous comms link, usually between a pair of modems, bytes must clearly be picked out of the random-looking stream of 1s and 0s. Therefore, a start bit is added to indicate that the next eight bits are data – there might be a parity bit to check for missing bits and then there will be at least one stop bit.

DATA FORMATS

One of the most common data formats is eight data bits, no parity, and one stop bit – this is usually referred to as 8N1. The other commonly used format is 7E1 – seven data bits, even parity and one stop bit. Both formats have a start bit to make 10 bits per character in all, hence 300bps equals 30 characters per second. Less common synchronous modems synchronise data transmissions and so start and stop bits are unnecessary. This makes them slightly faster as two out of 10 bits no longer need to be transmitted. Terminal programs usually have a data format option setting which must be matched with the same format used by the host computer you want to connect with.

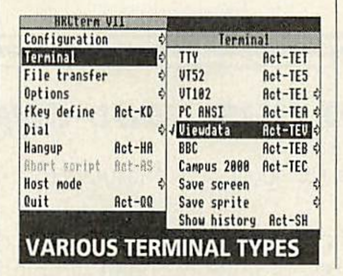
Although 300bps is a slow standard today, it was very common only five years ago. Today, most on-line services will offer 2400bps links and some go up to 9600 or even 14,400bps, and there are data compression techniques which can increase that speed by up to four times. The latest high speed modems can now effectively operate faster than the standard serial ports in either a Beeb or an Arc (19,200bps max).

Connected to the serial port you might have a cable linked to a modem or even directly linked to another computer. A quick word about cables – a computer-to-modem serial cable differs from a computer-to-computer or computer-to-printer version. The latter is known as a null-modem lead, which will not work with a modem. If you want to wire your own modem cable, a minimum of three serial port connections must be made. These are:

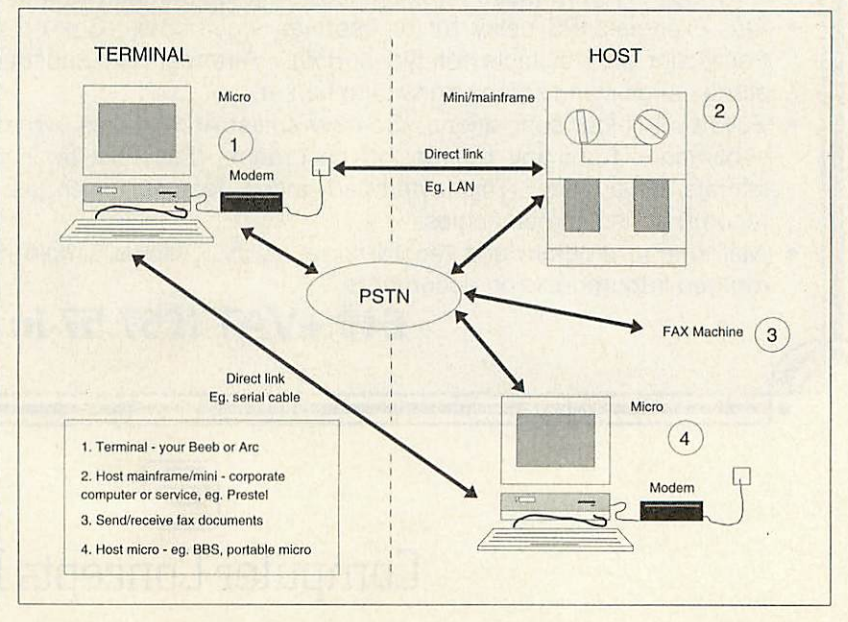
- Computer TX (or TD) linked to modem TX (or TD)
- Computer RX (or RD) linked to modem RX (or RD)
- Computer ground linked to modem ground

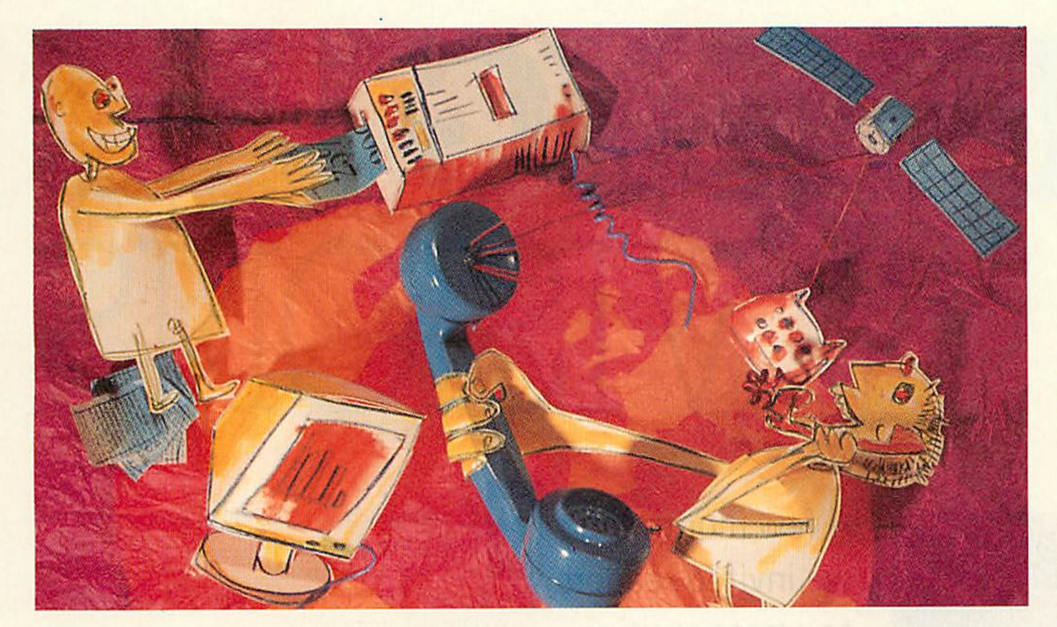
A null-modem lead swaps the TX/RX links over. Incidentally, because of some oddities in the Archimedes serial port, pins 1, 4 and 8 at the Arc end usually need to be wired together.

The CCITT (Committee Consultative Internationale de Telegraphique et Telephonique) is the international standards body responsible for telecommunications at the computer modem level and it has an agreed series of definitions for communications speeds. These definitions are labelled v, followed by a number – for example v2, v32, and so on.



VARIOUS TERMINAL TYPES





Quick Setup

HST/PEP (19200) — 8-None-1
V32 (9600) — 7-Even-1
V27 (4800) — Filter
v22bis (2400)
v22 (1200) — Accept
v23 (1275)
v21 (300)

TYPICAL MODEM SET UP

These are actually hardware definitions which describe tone generator frequencies and encoding/decoding, but they are generally used to indicate modem speed in lay terms. v22 is 1200bps and v32 is 9600bps. I use the term 'bits per second' here, as 'baud', can be misleading. Baud is often considered equivalent to bps, but baud actually refers to a frequency which can, in a modem link, be multiplied via efficient coding and so produce a greater bps rate.

GOING ON-LINE

Last month I said you could go on-line for as little as £20. Really good modems will probably set you back around £100 for a secondhand bargain, or about £200 upwards for a new one. However, there are lots of very cheap new and secondhand v23 manual (no auto-dial) modems which you can buy for as little as £20. Check out computer classifieds and computer fairs – models like the Prism 1000 or 2000 or OEL Telemod, GEC Datachat, or slightly more versatile modems like the WS3000 and Pace Nightingale are all worth looking at. These will work at 1200/75bps (v23) on most UK host services. If the comms bug bites deep, you can go on to an intelligent 2400bps (v22bis) model, or even one of the latest v32 (9600bps) beasts.

For Arc users I recommend *ArcTerm 3*. This is a public domain program written by The Serial Port and should not be confused with the commercial versions 6 and 7. It has all you need to get into comms and a bit more, although it isn't Risc OS compatible. For the Beeb, I would look out for secondhand *SoftMachinery*, *CommSoft* or Beebug *Command* Roms. Pace's *Commstar* is also good to start with.

Once you have your modem set up, try these numbers for starters:

The World of Cryton – scrolling text Archimedes BB. Tel: (0749) 679794.

Prestel Demo Database – viewdata mode. Tel: (0272) 250000 (ID and password are all 4s).

Equinox – the BB run by *BAU*'s comms columnist, Paul Vigay. Tel: (0705) 871531 (viewdata or scrolling).

SID – Acorn's Support Information Database, viewdata mode. Tel: (0223) 243642245.

JARGON BUSTER

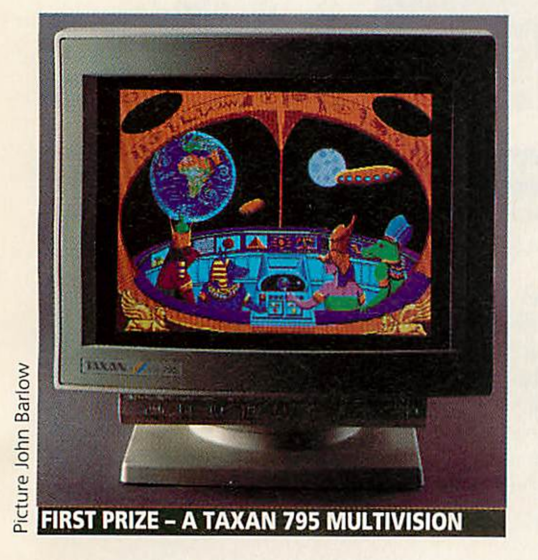
AN AT-A-GLANCE GLOSSARY OF COMMS TERMS

- **RX or RD** Receives data line in a serial connection
- **TX or TD** Transmits data
- **DUPLEX AND HALF DUPLEX** Duplex is a simultaneous two-way conversation, with data flowing in both directions at the same time. Half duplex is where the conversation only flows one way at a time and must be switched around to enable both sides to send and receive. Half duplex is cheaper to implement than full duplex, but less desirable. Simplex a one-way only link – a good example is broadcast teletext
- **v21** The CCITT (Committee Consultative Internationale de Telegraphique et Telephonique) protocol describing 300 bits per second (bps) transmission speed between modems. Details how the tones transmitted at either end of the phone link are interpreted. v21 is a full duplex speed
- **v22** As above, but at 1200bps
- **v22BIS** As above, but at 2400bps. This is the most cost-effective speed in use today
- **v23** As above, but half duplex 1200bps or full duplex 1200bps send and 75bps receive or vice versa. It can also describe 600bps half duplex. Most commonly known for 1200/75bps which used to be the standard for viewdata services, such as Prestel
- **v32** 9600bps
- **FULL DUPLEX** The up and coming standard, although requiring expensive modems
- **v32BIS** An extension of v32 capable of 14,400bps, or over 10 times faster than v22 or v23
- **PSTN** The Public Switched Telephone Network you plug your telephone into
- **DTE** DATA Terminal Equipment. The computer at either end of the communications link – eg, your Beeb or Arc at one end and a PC running a BB at the other end are both DTEs
- **BPS** Bits per second, the rate at which binary data is transmitted. If Ascii characters are being carried you can, as a rule of thumb, divide the bps figure by 10 to calculate how many characters per second are being transmitted
- **HANDSHAKING** Hardware or software signals which inform either end of a comms link when to start sending data and when to stop, especially when a buffer has become full
- **BAUD** The rate of signalling elements in a comms link. Sometimes equivalent to the bps rate of that link but especially where higher speeds are concerned, the true bps rate may be a multiple of the baud rate
- **SYNCHRONOUS** Data transmission is clock-synchronised. The transmitter and receiver know precisely where the beginning and end of a byte are in a stream of bits without needing marker start and stop bits
- **ASYNCHRONOUS** The transmitter and receiver are not synchronised and so the receiver must recognise individual bytes by noting start and stop bits surrounding the data bits. Most modems for the personal computer market work this way

NEXT MONTH

I will investigate handshaking, wiring of cables, serial port connections, intelligent modems and file transfer protocols.

WINNING VISIONS



Picture John Barlow

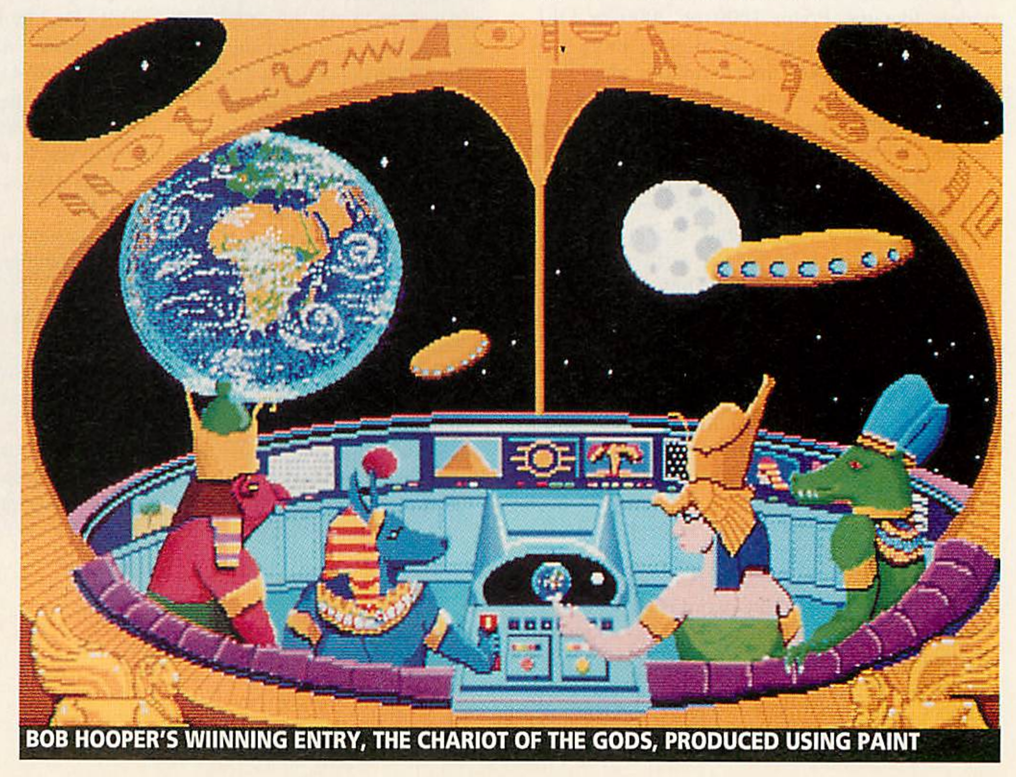
FIRST PRIZE – A TAXAN 795 MULTIVISION

A few months ago we invited readers to create exciting graphics and enter our competition to win a Taxan 795 monitor. **BARRY MONK** reports on the judging panel's verdict

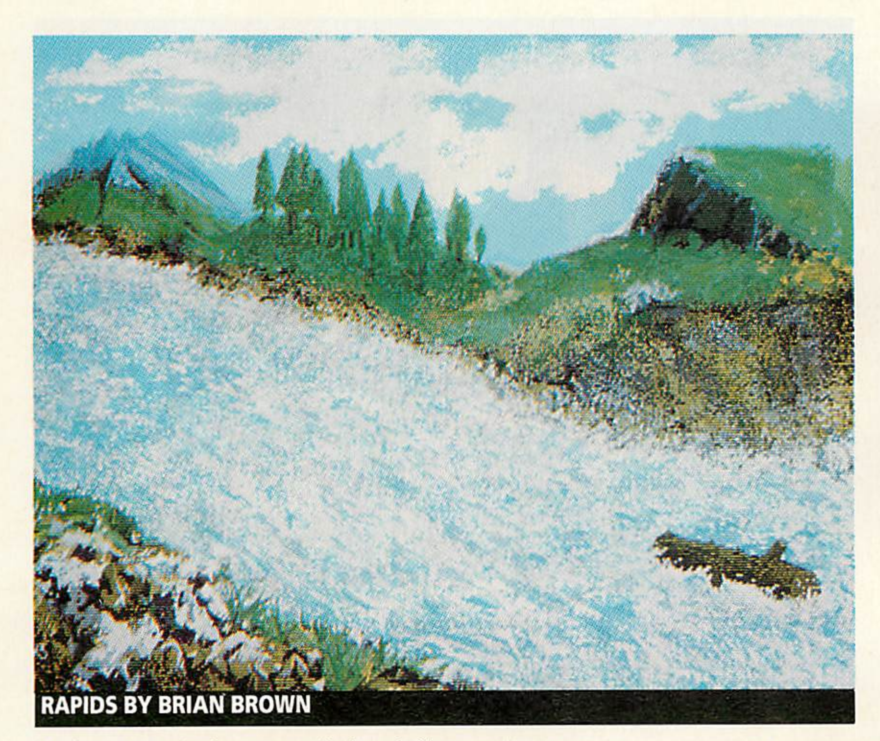
The Archimedes/A3000 has a reputation for producing good graphics. So a few months ago we asked readers to show us exactly what could be done – and what a creative bunch you turned out to be!

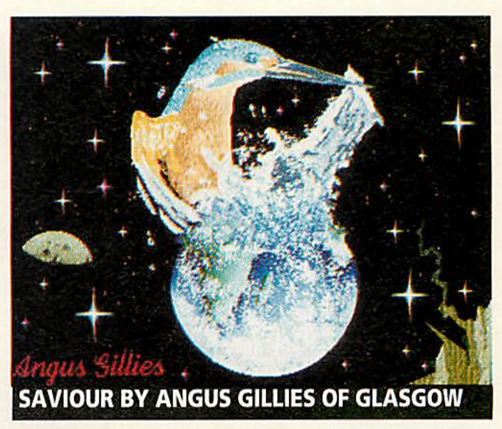
As a special 'carrot' to attract your entries, a 795 Multivision monitor, fitted with Atomwide's VIDC enhancer, was offered as first prize, courtesy of Taxan (UK) Ltd. Discs arrived at the *BAU* offices from Arc users of all ages and interests, from schoolchildren to high-tech art freaks. There were no special categories – we were looking for the best example of graphics produced on an Archimedes which would best demonstrate the high-resolution capabilities of the Taxan 795 monitor.

The panel of judges – which included Hugh Chappell and Denise Buck from Taxan and Paul James and myself from *BAU* – scanned carefully through all of the submissions. What became immediately obvious was the sheer high quality of the entries, many of which were not produced using expensive art packages, but instead made use of the built-in Archimedes applications, *Paint* and *Draw*.



BOB HOOPER'S WIINNING ENTRY, THE CHARIOT OF THE GODS, PRODUCED USING PAINT

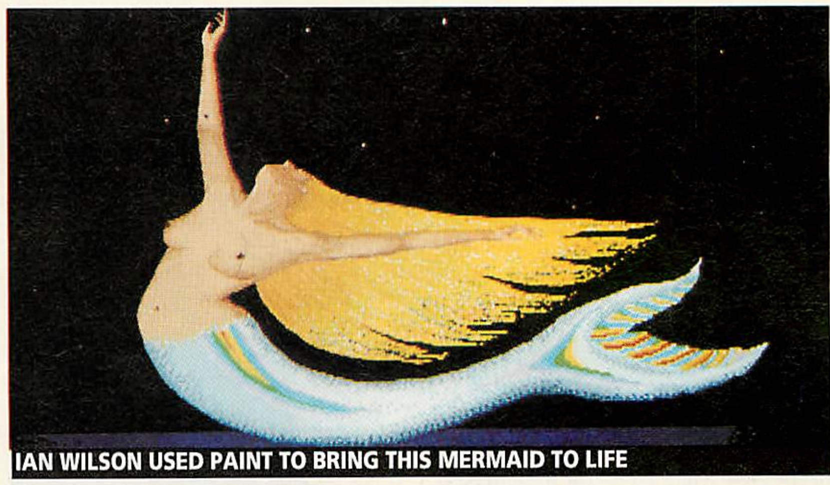

RAPIDS BY BRIAN BROWN

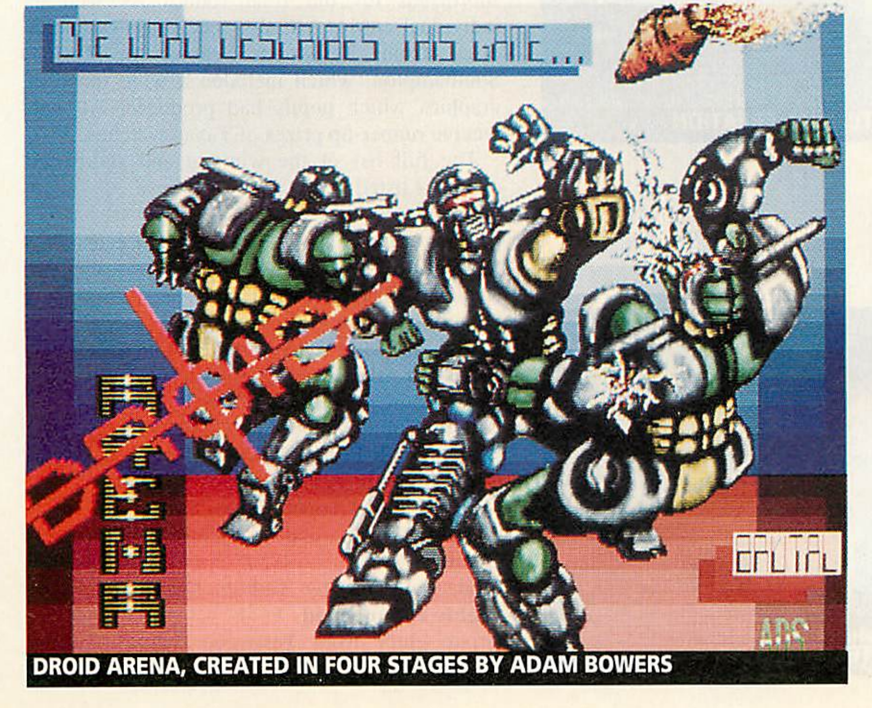


SAVIOUR BY ANGUS GILLIES OF GLASGOW

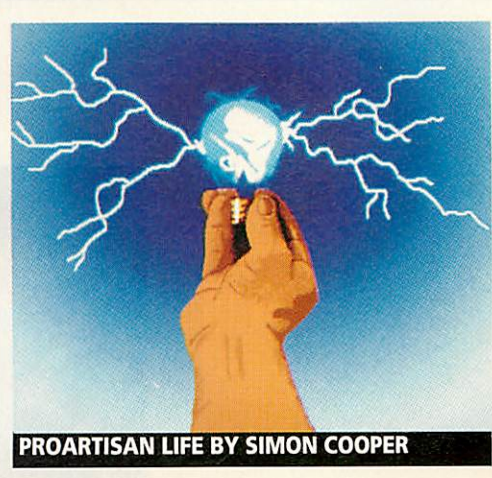
In fact, the winning entry (below left) proves both the ease of use of the A3000 and the creative possibilities offered by *Paint*. Winner Bob Hooper, age 43, bought his first computer, an A3000, nine months ago. He chose the machine on the recommendation of his wife, a teacher, and, being a keen artist and science fiction fan, he set about producing his graphical masterpiece for the competition. Called Chariot of the Gods, the image was created in about six hours using *Paint* and, according to Bob, the whole excercise was 'relatively easy'.

In fact, Bob said that, if more memory had been available, he would have made the image even more complicated. Even so, the panel agreed unanimously that the theme and its execution more than justified first prize – and it beat off good competition from graphics created

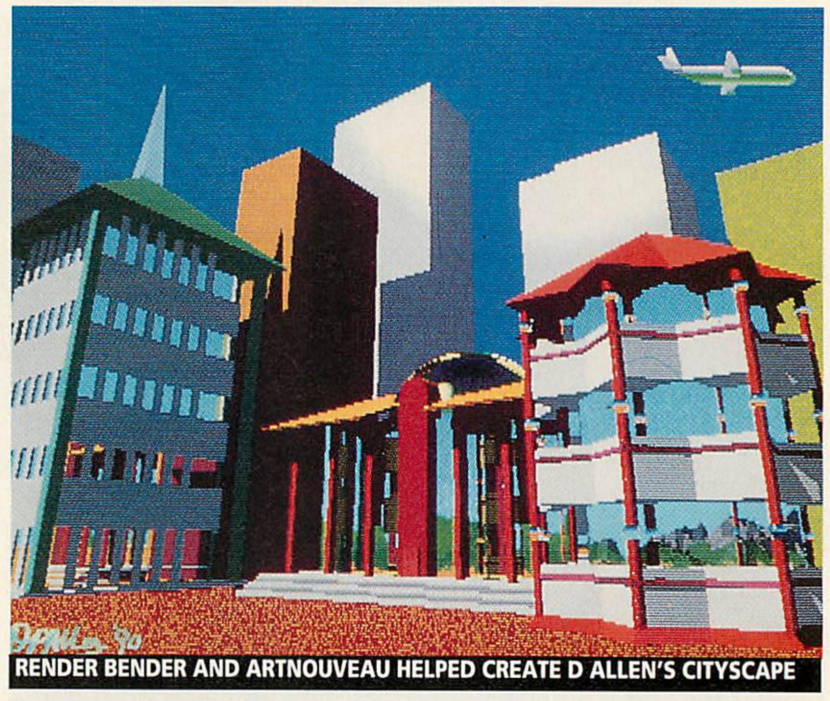

IAN WILSON USED PAINT TO BRING THIS MERMAID TO LIFE

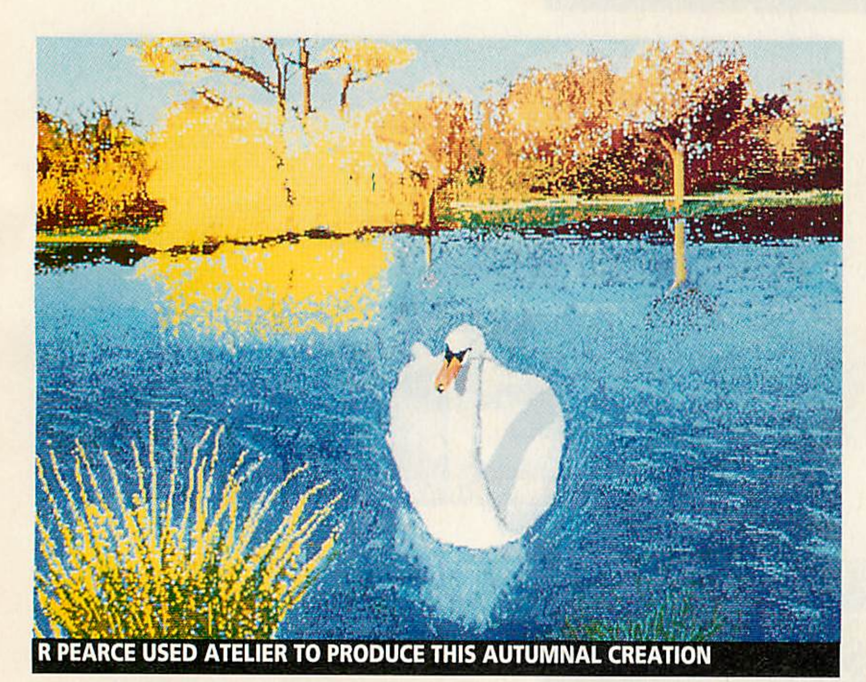


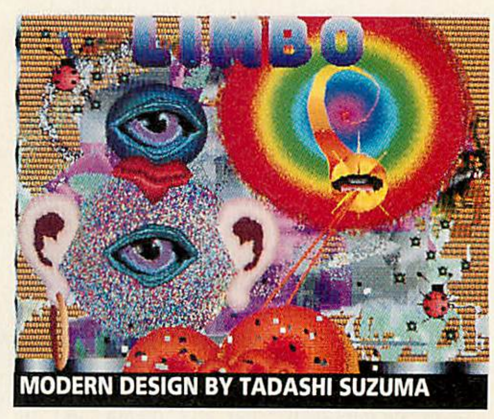
DROID ARENA, CREATED IN FOUR STAGES BY ADAM BOWERS


PROARTISAN LIFE BY SIMON COOPER

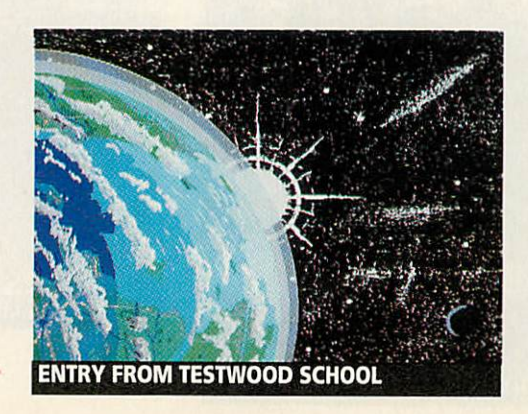

GREMLIN BY E AND K CLOVER


RENDER BENDER AND ARTNOUVEAU HELPED CREATE D ALLEN'S CITYSCAPE


R PEARCE USED ATELIER TO PRODUCE THIS AUTUMNAL CREATION



MODERN DESIGN BY TADASHI SUZUMA


ENTRY FROM TESTWOOD SCHOOL

with more expensive art packages.

All the entries were viewed and 12 were shortlisted for the final round. As well as individual entries, we also received a couple of discs from Testwood School, in Totton, Southampton, which included a wide range of graphics which pupils had produced. All will receive runner-up prizes of Taxan watches.

The full list of the winning and shortlisted entries is listed below.

Winner

Chariot of the Gods by Bob Hooper, Leeds

Runners-up

Rapids by Brian Brown, Hull
Saviour byAngus Gillies, Glasgow
Mermaid by Ian Wilson, Wallington, Surrey
City by D Allen, Camberley, Surrey
Xmas Church by David Marshall, Retford, Notts
Park by Colin Garden, London N4
Autumn by R Pearce, Wickford, Essex
Droid Arena by Adam Bowers, Sheffield
Life by Simon Cooper, Pitsea, Essex
Gremlin by E and K Clover, Timperley, Cheshire
Modern Design by Tadashi Suzuma, London

Highly commended

Group entry from Testwood School, Totton, Southampton



How to design a simple poster on your A3000 using Edit, Draw and Paint

POWER POSTERS

Last month we showed you how to design a simple document (a jam pot label) on screen using the A3000's built-in applications, *Paint, Draw* and *Edit*. Now you should be ready to further explore the desktop publishing capabilities of your machine by having a go at designing a poster.

Fonts are important on the Archimedes and many different types are available. On older machines, the fonts supplied are called bitmap fonts – the letters are like a sprite, so the larger you make them, the chunkier they become. Owners of an Acorn font pack or any DTP package will have the new font system, called the outline font manager.

Just like drawfiles, these new fonts are made from lines and curves, so they stay smooth no matter how big they get. To check your version of the font manager, first bring up the directory viewer of your fonts disc, so that the module can be loaded from inside the application.

Now press F12 to access the command line and type HELP MODULES. In the list that comes up you will find Font Manager, and a version number next to it. The newer outline font manager will have version number 2.44 or greater, with lower numbers representing the older bitmap font manager.

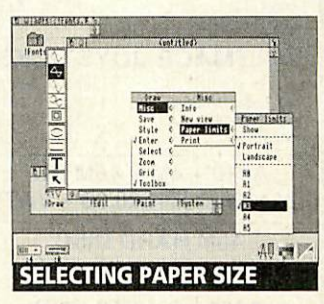
If you don't have the new font manager, you can buy a font pack from Acorn, which includes the module together with a few fonts to get you started. But the best way to obtain the outline font manager, and a few fonts, is by purchasing a DTP package such as Computer Concepts' *Impression* or Beebug's *Ovation*, thereby killing two birds with one stone.

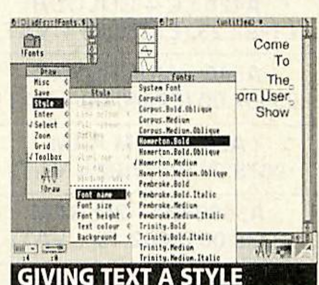
But this month's First Steps project involves producing an A3-size poster (twice the size of A4) using *Paint, Draw* and *Edit*. You are probably wondering how this can be produced on a standard printer which only takes A4 sheets. Well, there is a way of doing it...read on.

The best disc setup for this exercise is to have *Paint, Edit, Draw* and your System directory on one disc and fonts on another, decreasing the amount of time you spend changing discs when using the different applications, which can be frustrating. Don't forget to use the Ram disc (set it to 800K temporarily) to speed up copying.

Show your A3000 System and Fonts applications and then load up *Draw* and activate it by clicking on its icon, swapping discs as necessary. Now set the paper size (from the Misc and

Illustrations by Simon Rees


SELECTING PAPER SIZE


GIVING TEXT A STYLE



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Paper Size menus) to A3 portrait (press Adjust on Portrait, Select on A3!). You won't be able to see the whole of the A3 sheet, so zoom it down to 2:7 and the whole sheet will be visible on screen. This allows you to visualise your poster before printing it out.

The example used here is a poster for the forthcoming *BBC Acorn User* Show, but it could be adapted to design any poster for a school jumble sale, local gymkhana or similar event.

The first thing to do is put the words on the poster. Click on the Text tool in the toolbox (the T) and give the text a style by choosing a medium font from your Text Font menu. I used Homerton for this example, but you may select any font from the menu.

If the only font you have on your list is System font, this means that your A3000 does not know where your fonts disc is, ie, you have not shown the A3000 the Fonts application. If this happens, quit *Draw*, show the disc with the Fonts application on it to your computer and reload *Draw*. Also, check that the font cache has at least 72K of memory set aside for it, using the task manager display.

Click in the *Draw* window and, when the caret appears, type 'BBC Acorn User'. The computer will ask you for your fonts disc, so insert this into the disc drive, which should whirr into action – after a short delay the text will appear on the screen. Now if you type anything, the disc drive will not whirr again because the font definitions are now in the font cache – reading from memory is far faster than reading from the floppy disc, which is why it is important to have a sizeable chunk of memory set aside. If you had no font cache configured your machine would not be able to hold any information about the font in memory and would have to read it straight off the disc, which can take hours!

Press RETURN and the 'BBC Acorn User' text is now a draw object. Now type 'Come' 'To' 'The', and 'Show', pressing RETURN after each word to make sure they are also separate objects.

Now if you choose the Select tool (the arrow at the bottom of the toolbox) you can move the three objects about and arrange them approximately as shown. If you have a family of fonts – ie, medium, bold, italic and bold italic – then it would be a good idea to accentuate the BBC Acorn User as shown here. Do this by selecting the object and choosing another font from the text font submenu.

You can also do this with multiple selections, by selecting the objects you wish to change and then choosing the fonts you wish to plot them in. Don't forget to use the grid so you can line up the text accurately.

Here I will digress slightly. If you use any single quotes (' or ') in your poster then don't use the ones from the key to the left of RETURN. The font you are using has its own 'smart' quotes (66s and 99s for those of you who remember their school days). To access these you need to use the numeric keypad on the right-hand side of your keyboard. Hold down the ALT key and type 145 on the numeric keypad, then let go of ALT. A single closed quote (') will appear, which looks better then the (') character from the quote key. (Incidentally, the open quote keystroke is ALT 144 while double quotes are ALT 148 and ALT 149 (" and ").

Type in the other details, 'Wembley Conference Centre, October 11-13, admission £6 for adults, £4 for children, Family ticket £16, Special prices for advanced tickets', in 40pt text. You can then move each object around and re-size it until you are happy with how it looks.

The best way to re-size the text is with the magnify box or the editable field in the Font Size menu. If you use the re-size ear then you will lose the aspect ratio of the text.

Select a text object and then move over the Select submenu into the Magnify box. Typing 2 into here the text will double in size and typing .5 will halve it. Of course, you can still use the re-size ear if you want your text to look squashed or stretched.

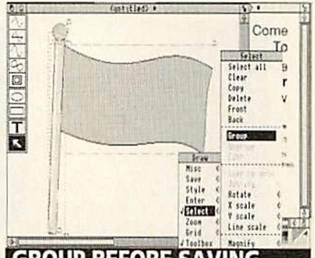
Now for clip art. All good posters have artwork on them and, in most cases, it can easily be added. Bring up another draw window by clicking on the icon and draw the flag shown here. After you have finished it, group all the separate objects into one big object by choosing Select All, then Group.

Now you can save your flag object onto the poster window by going over the Save Selection menu and dragging the save box onto the poster – it will appear as a selected draw object. Move the flag into the position shown and scale it up.

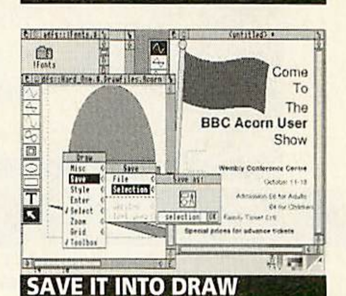
You can add more artwork by drawing it in the smaller window (your 'sketch pad') and then saving it onto the poster. Don't forget to Select all and Group the artwork first. You can also save sprites and large text areas into *Draw* the same way, as demonstrated last month.

Now all you need to do is print your A3 poster. Select all of the objects on your poster and group them as one. Load the printer driver and tick Show from the Paper Size menu by clicking Select on it. A grey border will be drawn on the page and the white area is where your printer can print. Move your poster so that you can print one corner and, when this is printed, move the poster so the part that was not printed is in the white area. When all four parts of your poster have been printed, you need to glue them together. If you are producing several posters, you can photocopy the individual sections before putting them together.

So there you have it – a poster designed and printed with the software supplied on your A3000.

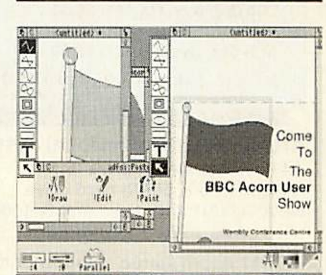


GROUP BEFORE SAVING



SAVE IT INTO DRAW

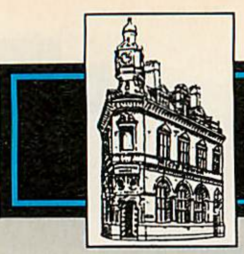
GROUP BEFORE PRINTING



PRINTING THE FOUR PARTS

COMPETITION

We would like to see your design of A3 poster advertising our show, using only Paint, Edit and Draw. Send in a drawfile containing your design and we will print out the entries here at the BAU office. We may include the best in a forthcoming issue and display them on our stand at the show. The first prize will be a copy of 4Mation's Poster program, which will help the winner develop his or her poster designing skills still further.



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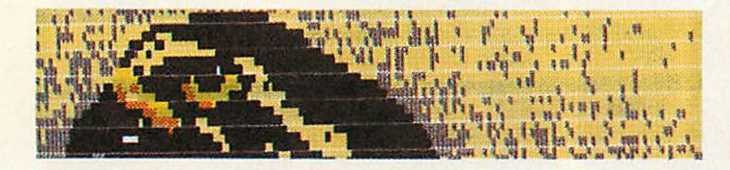


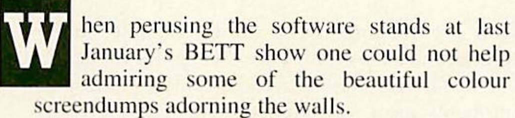
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PRINTING PRETTY

CHRIS DRAGE finds it doesn't cost the earth to furnish the classroom with colour





When perusing the software stands at last January's BETT show one could not help admiring some of the beautiful colour screendumps adorning the walls.

These days most software includes a colour printer driver or, in the case of the Archimedes and A3000, makes use of the Risc OS printer drivers. Colour printing in school is a tempting option and prices for colour dot-matrix printers have been dropping as the number of facilities they offer has increased.

From the educational view, when children can obtain a colour print of their work the satisfaction is immense, and with the National Curriculum's emphasis on presentation skills, it becomes increasingly easier to justify the purchase of a colour printer.

What follows then is some help to get you started, including an appraisal of some colour printers and additional software which will facilitate the production of colour pictures guaranteed to astound the teacher next door.

HARDWARE

What printer do I need? This is not an easy question, as the whole area of computer printing is a rapidly developing one with some companies bringing out new and improved models at an alarming rate. What is becoming increasingly clear is that colour for dot-matrix printers will soon be included as standard.

Starting at the top of the colour printing spectrum there are colour laser printers whose reproduction is quite astonishing but the cost of such printers is so prohibitive, it makes this option inaccessible to schools.

Next in terms of both quality and performance come colour inkjet printers represented by Hewlett-Packard and Integrex.

Firstly, some points about inkjet printers generally – the quality of the resulting image has a lot to do with the quality of paper used. Too coarse a paper tends to produce jagged edges while glossy art paper absorbs the ink and you end up with a runny mess. Manufacturers always recommend their own paper, however, in my experience you can match or even exceed the quality and price by shopping around. Crown Graphic for example, supplies its own inkjet quality paper to schools at a price hard to match.

The inkjet principle enjoys one or two major advantages over the dot-matrix printer – ink cartridges don't gradually dry out as ribbons do, but maintain their quality to the point of exhaustion. Similarly, they never suffer from cross-colour contamination which all colour ribbons are prone to do. However, they do cost more. Be wary too of exaggerated claims concerning cartridge life – in practice it depends on how you use the printer. If you always print in 'high quality' mode then cartridge life will be less. Low noise is another attribute of inkjet printers, very welcome when used in the classroom.

Hewlett-Packard has established a reputation for high quality printers. It is not by accident that its Laserjet series of laser printers has virtually been adopted as an 'industry standard'. Although these are expensive, the HP Paintjet is within the price range schools could afford. It is physically similar to its monochrome Deskjet cousin, sharing its quality in construction and having all its facilities easily to hand. What I particularly like is its ability to accept various stationery – fanfold, cut sheets and transparency film (HP's brand only) and the ease at which cartridges and paper can be loaded.

Don't expect much BBC B software to have a Paintjet driver built in, at best you will have to write your own. Arc owners fare better with a Paintjet driver available from Ace Computing which can print colour images in low, medium, or high resolutions.

In my experience there is only one colour printer that consistently offers truly bright colour output – the Integrex 132 Colourjet. Based on the Canon PJ-1080A machine but with Integrex's own firmware on board, the Colourjet outperforms all dot-matrix printers and rivals the Paintjet using Ace Computing's Integrex driver. Like the Paintjet, the Colourjet 132 is virtually silent in operation and ink cartridges do not dry up, generally having a long life. Being compatible with a wide range of computers in use in education, the popularity of the Colourjet 132 has prompted many software publishers to include Integrex printing routines in their BBC B software so that increasingly, children are able to obtain a colourful copy of their work.

Lacking only the Paintjet's ability to print on fanfold paper, the Colourjet can also print overhead projector transparencies and even print on to textiles. By choosing good quality, coated paper the results can be rewarding, especially for children with special needs for whom a colour printer is a valuable resource.

For many schools however, funding will only stretch as far as cheaper dot-matrix printers and here you are spoilt for choice. First though, I want to explode a myth about dot-matrix printers before comparing various types and

models. Frequently, you will see advertisements claiming that so-and-so's printer can print with a resolution of 360 × 360 dots per inch (dpi is the standard means of comparing printer resolutions). You may shudder as you realise that the best your printer can output is 180 × 180dpi. However, this printing resolution is about optimum for dot-matrix printers whose quality is governed as much as anything by the size of the pins in the print head. When you begin to increase the printing resolution two things happen – the colour saturation improves but detail and tonal subtleties get lost. Also there is more chance for discolouration at resolutions above 180 × 180dpi. No colour dot-matrix printer can match the Integrex Colourjet combined with the Ace Computing driver when dumping a mode 15 sprite on an Arc, for example. Some may obtain equal degree of colour saturation but significantly lose detail. Once reduced to about 180 × 180dpi they accurately resolve the image detail but lose colour saturation and look 'faded'. Dot-matrix printers also suffer from fading ribbons, noise and ribbon-banding across the printed image although obviously some models are better than others. Where they score over the inkjets is that a wider range of fonts are available when using a BBC B/Master 128.


HP PAINTJET


STAR LC200


STAR LC24 200


CITIZEN SWIFT 24


INTEGREX COLOURJET

If your funding can only stretch to a nine-pin printer then my vote goes to the Star LC-200 which is comparable in every way with similar, Epson-compatible printers from Citizen, Panasonic, etc. Being a direct descendent of the very popular LC-10 colour printer the LC-200 replaces that particular model. Like its predecessor the LC-200 offers Epson JX compatibility which means that your existing JX-80 printer driver/dump will work. The results can be just as good as those from 24-pin printers but takes twice the time to print.

For an extra £50-£100 you can buy a 24-pin printer. Models which are destined to see service in many schools are the Star LC24-200 and the Citizen Swift 24 and 24x. The LC24-200 is designed as the colour equivalent of the LC24-10.

Styled very much like the LC-200, the 24-pin model possesses all those features which make the LC 24-pin series so successful – a range of resident fonts and styles, an excellent control panel and easy paper handling. The LC24-200 performs its dumps well but the review model rather suffered from ribbon-banding on the print – more so than the nine-pin model. However, if you are looking for a sturdy, reliable colour printer the LC24-200 is good value for money.

As far as schools are concerned, Citizen is probably most well known for its popular 120D nine-pin dot-matrix printer. With aggressive marketing and a determination to pack as much printer-per-buck as possible, its range of 24-pin models will render the ubiquitous nine-pin printer obsolete within a year or two. In addition, Citizen provides its own Archimedes printer dump as an option. All Citizen printers can be upgraded with an additional colour kit which is very straightforward to install – simply plug in the colour decoder and swap the ribbons over and you have a colour printer. This system adds to the cost but you get the choice of purchasing the printer now and adding colour later.

The standard machine is the versatile Swift 24. Unlike other printers in its class it provides an LCD control panel which displays menus from which the printer can be set up. For school however, there are two further features which will probably sway your decision – a simple-to-use control panel and excellent paper handling.

The wide-bodied (132 column) version, the Swift 24x, is identical in all respects to the 80-column model and performed the best dumps of any of the dot-matrix printers with hardly any ribbon banding. It also produced the best 180 × 180dpi dump but does cost an extra £100.

CONCLUSION

Each of the above printers can be recommended as they all performed well, appear rugged enough and seem reliable. Choice based on the facilities offered (mode of operation and print quality, etc) is a subjective one, as the running is very close. For versatility the Citizen Swift 24 is hard to beat but the Star LC24-200 costs less.

To date the nine-pin printer still offers the most cost effective means of obtaining a coloured copy of textual or graphical information from the computer and here the Star LC-200 is a clear winner.

Using inkjet technology overcomes the problems of banding, ribbon wear, drying out and discolouration – common dot-matrix problems. Despite its relatively high cost, the Integrex Colourjet is still the logical choice for colour printing in schools. In all cases it pays to shop around to pick up the best discount you can.

Next month I will look at software and hardware which will help you to get the best out of your colour printer.

PRODUCT DETAILS

The Citizen Swift 24 and Swift 24x are available from Citizen Europe Ltd, Wellington House, 4/10 Cowley Road, Uxbridge, Middlesex UB8 2XW. Price: £365 and £489 respectively. Colour upgrades cost from £38 - £41 depending on the length of carriage you require.

The Star LC-200 and LC24-200 are available from Star Micronics UK Ltd, Craven House, 40 Uxbridge Road, Ealing, London W5 2BS. Price: £259 and £319 respectively.

The Integrex Colourjet is available from Integrex Ltd, Church Gresley, Burton-on-Trent, Staffs DE11 9PT. Price: £636.

The HP Paintjet is available from Crown Computer Products, Crown House, Plantation Road, Burscough Industrial Estate, Burscough, Lancs L40 8JT. Price: £625 including 12 months on-site maintenance.

For Integrex/HP Colour inkjet supplies for schools and colleges: Crown Graphic, PO Box 774, Clyde Vale, Forest Hill, London SE23 3JW.

Risc OS printer drivers are available from Ace Computing, 27 Victoria Road, Cambridge CB4 3BW. Prices: Integrex upgrade £5. Hewlett Packard Paintjet £15. Epson JX compatible £15. (Star LC-200, LC-24/200, Citizen Swift-24 colour) Canon PJ 1080-A £15. Integrex Colourcel £25.

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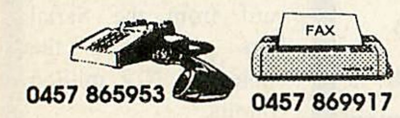
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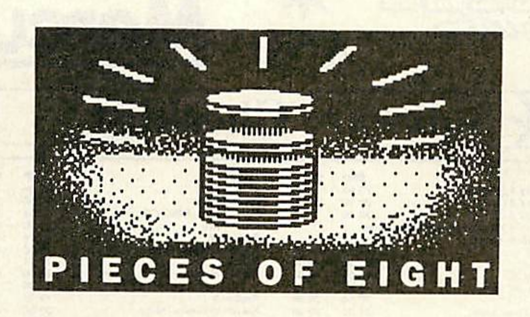
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SEASONED PLAYERS

As I sat down to write this months' Pieces of Eight I took a look out of my window and stared for a moment at the pouring rain. Seeing as I had planned to do a spot of sunbathing, I thought 'wouldn't it be nice if we could change the weather?' Strangley enough (Ahem) while looking through my set of back issues searching for a couple of classics to bring you this month I found this little wonder from **Peter Barry**. Peter's program was published in December 1983 and it draws random landscapes. With the press of a key you can change the colour palette to represent the colours associated with the season – no mean feat on the eight colour Beeb.

The thing that impresses me most of all about Peter's program is that no complex 3D formula or fractal graphics are used. The picture is daubed on the screen with a few swipes of a sine curve, a dash of dithers and a smidgen of circles.

Landscape pictures are usually well structured in their make-up and Peter's program follows the same set of rules. The picture is started with the background hills, which are painted in a dull colour to represent distance (as all good artists should know), then a lake is drawn. Another set of hills are drawn over this with the same PROChills procedure, with colours adjusted to suit and finally the grassy field in which you are standing is added.

To add further to the feeling of perspective, a winding road is drawn, getting wider as it comes closer. Around this, fast growing trees are planted in varying shades and sizes, and they get smaller as they fade into the distance.

People who have the *GXR* Rom fitted can speed things up here by replacing the circle-drawing routine (in PROCtrees) with the much faster circle routine in the Rom.

The final section of the program deals with altering the palette according to the data statements at the end. The program then cycles through the four seasons – from winter to spring, spring to summer, etc...

Me? I set the season to summer, put on my shades, shut the curtains and laid back to relax... Hold on a minute, where did that cloud come from? I don't remember a PROCrainstorm procedure!

Incidentally, watch *INFO next month for a 'simulating nature' special.

The second progam to be unearthed this month is the popular 3D Polyominos game from October 1988. **Don Scales** suggested the routine, **Dave Lawrence** wrote it and I'm sure you'll agree that it's a great puzzler.

Pentominoes are made up from five squares, of which 12 different shapes can be made, ignoring mirror reflections and rotations. It is possible to construct four different rectangles from them.

Don's program takes this to another dimension, and challenges you to arrange the now 3D 'polyominoes' so that they fit inside a cuboid. The program (listing 2 on the yellow pages) will run quite happily on a Master and Archimedes but BBC and Electron owners with disc interfaces will need to set PAGE to &1100 before running. Arc owners will also have to make a slight key adjustment, namely change the _ to a / in line 320 and in line 330, the \ to a '.

When the program runs it will first ask you for the dimensions of the cuboid you wish to build, there are three possible variations, all equally difficult.

The screen display is divided into three sections. The box at the right of the screen is your 'playing board' and is the outline of the cuboid you are trying to fill. Inside this box is a red dotted cube. This is the cursor and is where the


SNOW ALL YEAR ROUND


SUMMER IN RANDOMLAND




SOFTWARE Bargains AND Mercury Games

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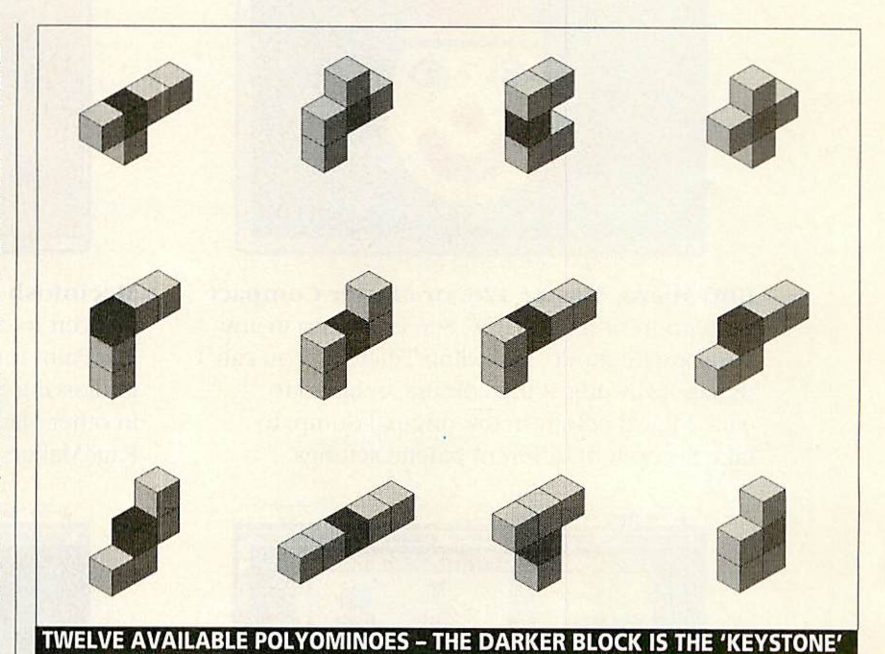
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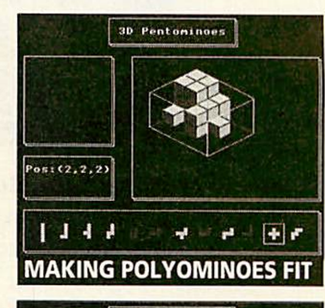


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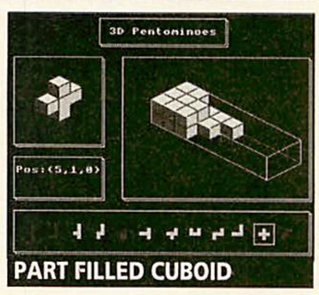

TWELVE AVAILABLE POLYOMINOES – THE DARKER BLOCK IS THE 'KEYSTONE'

KEYS FOR POLYOMINOES

Cursor Left	:
Cursor Right	: Move place cursor
Cursor Up	:
Cursor Down	:
£	Move place cursor up
–	Move place cursor down
Archimedes owners should change these keys (lines 320 and 330) to ' and /	
<	Move selection cursor left
>	Move selection cursor right
SPACE	Choose polyomino from cubiod
X	Rotate chosen polyomino about axis
Y	Rotate chosen polyomino about axis
Z	Rotate chosen polyomino about axis
RETURN	Place polyomino in cuboid
Q	QUIT



MAKING POLYOMINOES FIT



PART FILLED CUBOID

'keystone' of your chosen block will be placed. You can move this around inside the cuboid with the arrow keys, left, right, forward and backward. Moving the cursor up or down a level is achieved with the / and " keys. The bottom box is the selection of polyominoes you have left to fit into the cuboid – the currently selected one is highlighted by a red square. The ones you still have left are coloured yellow while the ones that have been placed inside the cuboid are red. You can select the shape you wish to use next with the < and > keys and you can confirm your choice with the SPACE bar.

When you have selected your polyomino it will appear in the top left-hand window. You can rotate it with the X, Y and Z keys and when you are happy with its orientation and position you place it in the box with RETURN. Of course if it doesn't fit in the space then you will be told and you'll have to try elsewhere. If you are not happy with the fit then press DELETE – you can remove any polyomino by selecting it in the bottom window and pressing DELETE.

The cursor in the cuboid shows where the next shape is to be placed. On each polyomino is a keystone, indicated by looking slightly larger than the other four.

This is the part of the shape that falls into the space occupied by the cursor. Take a look at figure 1 for the 12 possible variations, the darker block is where the keystone is.

You can quit the game at any time by pressing Q, but first you will be given the option to restart (useful if you get stuck), or quit completely and return to Basic.

Don offers a few useful hints that may help you in solving the puzzle.

Once you've put in a few polyominoes you'll begin to find it more difficult, and if you get it wrong you won't be able to insert the last couple. One thing you should do is begin building at the back of the cuboid, otherwise you may obscure holes behind other polyominoes. And don't think too dimensionally, you can't solve it by building a layer at a time.

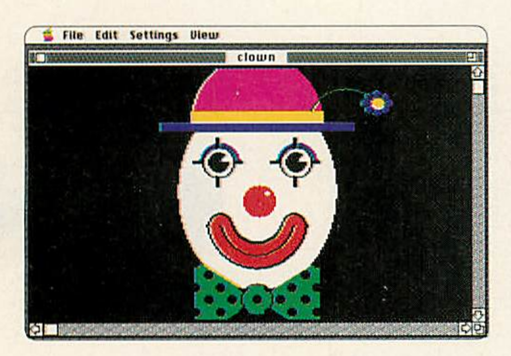
Finally this month comes something a little more simple than weather controlling programs and 3D polyominoes. This neat little routine was published in Eight Bits of October 1989.

Murray Mackenzie's program shows redefining characters within a string to provide a revolutionary scrolling routine. It doesn't go sideways, but drops characters in from the top.

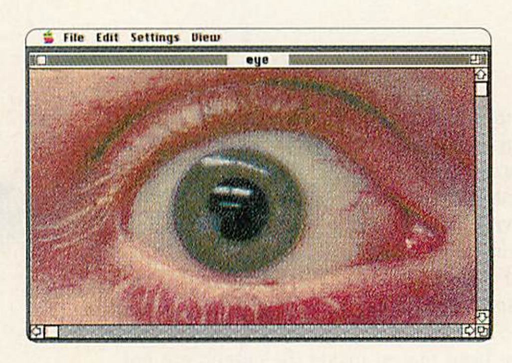
The first program drops one string in, and continues to do so. The second program replaces the old string with a new one giving a rolling effect, as if the characters were glued to a drum.

The first routine works by taking each character of the string and redefining it eight times, each time moving a row of bits down one byte, then printing it over the old character. The second routine does the same, except that rows yet to be scrolled to aren't cleared, leaving the old character underneath. On an Archimedes the effect is lost because the routine is too fast. You could insert a delay inside the main loop with dummy=INKEY(3), this waits for three tenths of a second. Of course, if you have written a better routine for getting your message across then please send it in.

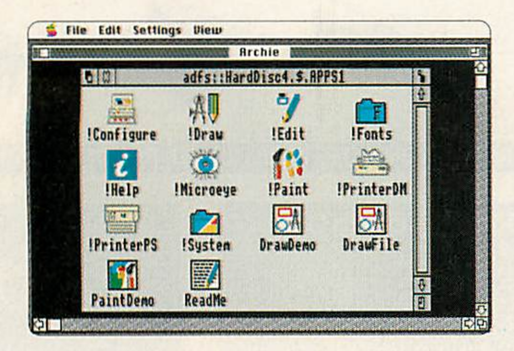
Announcing colour graphics conversion between the Acorn Archimedes and the Apple Macintosh



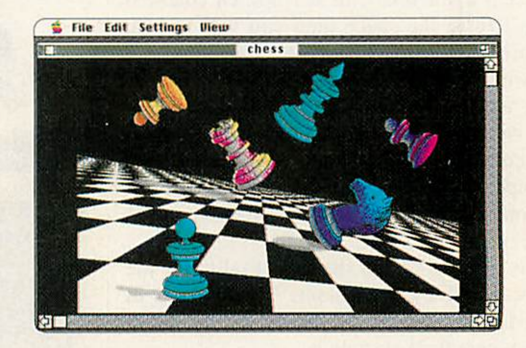
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Program	Page	BBC B B+128	B+/ 128	Master Compact	Master	Electron	6502SP/ Turbo	ADFS	Econet	Shadow Ram	Archimedes/ A3000	Monthly disc
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Info 1b		■	■	■	■	■	■	■	■	■		■
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Info 2b		■	■	■	■	■	■	■	■	■	■	■
Info 2c		■	■	■	■	■	■	■	■	■		■
Info 2d								■	■		■	■
Info 3a								■	■		■	■
Info 3b		■	■	■	■	■	■	■	■	■	■	■
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★Info

Listing 1

```
   10 REM >3DLiss (Info1a)
   20 REM 3D Maths in motion!
   30 REM by Michael Attenborough
   40 REM for Archimedes only
   50 REM (c) BAU July 1991
   60 :
   70 ON ERROR MODE 0:PRINT REPORT$" at
line ";ERL:END
   80 MODE 128
   90 PROCinit
  100 REPEAT
  110 D%=(D%+rotvel%) AND &3FF
  120 PRINT;A%;":";B%
  130 PRINTTAB(70,0);INT(E%*360/1024)
  140 IF C% PRINTTAB(79,0)"P"
  150 CASE TRUE OF
  160 WHEN INKEY(-122):IF rotvel%<30 rot
vel%+=1
  170 WHEN INKEY(-26):IF rotvel%>-30 rot
vel%-=1
  180 WHEN INKEY(-101):E%=(E%-4) AND &3F
F
  190 WHEN INKEY(-86):E%=(E%+4) AND &3FF
  200 WHEN INKEY(-58):
  210 va%=(va%+4) AND &3FF
  220 !sin%=sin!(va%*4)
  230 !cos%=cos!(va%*4)
  240 WHEN INKEY(-42):
  250 va%=(va%-4) AND &3FF
  260 !sin%=sin!(va%*4)
  270 !cos%=cos!(va%*4)
  280 OTHERWISE:
  290 CASE INKEY(0) AND &DF OF
  300 WHEN ASC"Z":A%-=1
  310 WHEN ASC"X":A%+=1
  320 WHEN ASC"C":B%-=1
  330 WHEN ASC"V":B%+=1
  340 WHEN ASC"P":C%=NOT C%
  350 WHEN 16    :E%=0
  360 WHEN 25    :E%=&100
  370 ENDCASE
  380 ENDCASE
  390 ENDIF
  400 CALL start
  410 UNTIL FALSE
  420 END
  430 :
  440 DEF PROCassem
  450 DIM code 350
  460 x=0:y=1:z=3
  470 ai=12:bi=11:sa=9:cb=8:sb=7
  480 sp=13:link=14:pc=15
  490 temp=14
  500 FOR pass%=0 TO 2 STEP 2
  510 P%=code
  520 [OPT pass%
  530 .start
  540 STMFD   (sp)!,{link}
  550 ADR     ai,vars
  560 STMIA   (ai)!,{R0,R1,R3,R4}
  570 LDMIA   ai,{sb,cb}
  580 MOV     temp,#&400
  590 SUB     R10,temp,#1
  600 .loop
  610 ADR     R0,vars
  620 LDMIA   R0,{R0,R1,R3,R4}
  630 \ look up sines and cosines and ap
ply formula
  640 MUL     ai,R0,temp
  650 AND     ai,ai,R10
  660 MLA     bi,R1,temp,R3
  670 AND     bi,bi,R10
  680 LDR     sa,[sb,ai,ASL #2]
  690 LDR     x,[cb,bi,ASL #2]
  700 MUL     x,sa,x
  710 MOV     x,x,ASR #11
  720 LDR     y,[sb,bi,ASL #2]
  730 MUL     y,sa,y
  740 MOV     y,y,ASR #11
  750 ADD     z,ai,R4
  760 LDR     z,[sb,z,ASL #2]
  770 MOV     z,z,ASR #1
  780 \ rotate around y axis
  790 LDR     ai,cos%
  800 LDR     bi,sin%
  810 MUL     R5,x,ai
  820 MUL     R6,z,bi
  830 SUB     R5,R5,R6
  840 MOV     R5,R5,ASR #10
  850 MUL     z,ai,z
  860 MLA     z,x,bi,z
  870 MOV     x,R5
  880 \ apply perspective
  890 CMP     R2,#0
  900 LDRNE   R5,perpos
  910 RSBNE   R6,x,#&400
  920 LDRNE   R6,[R5,R6,ASL #2]
  930 MOVEQ   R6,#&300
  940 \ plot point
  950 MUL     y,R6,y
  960 MOV     y,y,ASR #11
  970 ADD     y,y,#320
  980 MUL     z,R6,z
  990 MOV     z,z,ASR #22
 1000 RSBS    z,z,#128
 1010 BMI     skip
 1020 CMP     z,#256
 1030 BGE     skip
 1040 LDR     R0,scrpos
 1050 MOV     R6,#80
 1060 MLA     R0,R6,z,R0
 1070 MOV     R5,y,ASR #5
 1080 ADD     R0,R0,R5,ASL #2
 1090 AND     y,y,#31
 1100 MOV     R6,#1
 1110 LDR     R5,[R0]
 1120 ORR     R5,R5,R6,ASL y
 1130 STR     R5,[R0]
 1140 .skip
 1150 SUBS    temp,temp,#1
 1160 BPL     loop
 1170 \ swap screens
 1180 LDR     R1,bank
 1190 MOV     R0,#112
 1200 SWI     "OS_Byte"
 1210 STR     R1,bank
 1220 MOV     R0,#19
 1230 SWI     "OS_Byte"
 1240 LDR     R1,bank
 1250 MOV     R0,#113
 1260 SWI     "OS_Byte"
 1270 CMP     R1,#2
 1280 LDREQ   R0,scrpos1
 1290 LDRNE   R0,scrpos2
 1300 STR     R0,scrpos
 1310 SWI     &100+12
 1320 LDMFD   (sp)!,{pc}
 1330 :
 1340 .vars    EQUD 0
 1350 EQUD 0
 1360 EQUD 0
 1370 EQUD 0
 1380 .sinpos  EQUD sin
 1390 .cospos  EQUD cos
 1400 .perpos  EQUD per
 1410 .sin%    EQUD 0
 1420 .cos%    EQUD 0
 1430 .bank    EQUD 1
 1440 .scrpos  EQUD 0
 1450 .scrpos1 EQUD 0
 1460 .scrpos2 EQUD 0
 1470 ]
 1480 NEXT pass%
 1490 ENDPROC
 1500 :
 1510 DEF PROCinit
 1520 DIM sin 2048*4
 1530 cos=sin+256*4
 1540 PRINT"Filling sine array...";
 1550 FOR i%=0 TO 1023
 1560 sin!(i%*4)=&400*SIN(i%*PI/512)
 1570 NEXT
 1580 FOR i%=0 TO 1023
 1590 sin!((i%+1024)*4)=sin!(i%*4)
 1600 NEXT
 1610 DIM per &801*4
 1620 PRINT'"Filling perspective array..
.";
 1630 FOR i%=0 TO &800
 1640 per!(i%*4)=&600/(1+i%/&400)
 1650 NEXT
 1660 PRINT'"Assembling code...";
 1670 PROCassem
 1680 *FX 112 1
 1690 CLS
 1700 *FX 112 2
 1710 CLS
 1720 *FX 113 1
 1730 scr%=1
 1740 DIM iblock% 16
 1750 !iblock%=148:iblock%!4=149:iblock%
!8=-1
 1760 SYS "OS_ReadVduVariables",iblock%,
scrpos1
 1770 !scrpos=!scrpos1
 1780 A%=3
 1790 B%=4
 1800 C%=TRUE
 1810 D%=0
 1820 E%=256
 1830 va%=952:rotvel%=4
 1840 !sin%=sin!(va%*4)
 1850 !cos%=cos!(va%*4)
 1860 ENDPROC
```

Listing 2

```
   10 REM >3DLiss8 (Info1b)
   20 REM Original by Michael Attenborou
gh
   30 REM 8-bit version by Dave Acton
   40 REM for B/B+/E/M/C
   50 REM (c) BAU July 1991
   60 :
   70 MODE 4
   80 PROCinit
   90 *FX 4,1
  100 *FX 229,1
  110 *FX 12,10
  120 VDU 23;8202;0;0;0;
  130 CLS
  140 REPEAT
  150 PRINTTAB(0,0);?aa;":";?bb;"  "
  160 PRINTTAB(37,0);INT(?ze*360/256);"
"
  170 CALL start
  180 UNTIL INKEY-113
  190 *FX 4
  200 *FX 229
  210 *FX 12
  220 END
  230 :
  240 DEF PROCinit
  250 points=256
  260 mask=(points-1) DIV 256
  270 DIM code &800+3*points
  280 pt=&70
  290 a=&71
  300 b=&72
  310 d=&73
  320 temp=&74
  330 temp2=&76
  340 y=&78
  350 z=&7A
  360 bittab=&80
  370 nottab=&88
  380 osbyte=&FFF4
  390 PRINT"Assembling code..."
  400 FOR pass%=0 TO 2 STEP 2
  410 P%=code
  420 [OPT pass%
  430 .start
  440 LDA #19
  450 JSR osbyte
  460 JSR plot
  470 LDA bt
  480 CLC
  490 ADC rv
  500 STA bt
  510 LDX #256-122
  520 JSR inkey
  530 BNE nofaster
  540 LDA rv
  550 BMI faster
```

►

```
  560 CMP #30
  570 BEQ nofaster
  580 .faster
  590 INC rv
  600 JMP start
  610 .nofaster
  620 LDX #256-26
  630 JSR inkey
  640 BNE noslower
  650 LDA rv
  660 BPL slower
  670 CMP #256-30
  680 BEQ noslower
  690 .slower
  700 DEC rv
  710 JMP start
  720 .noslower
  730 LDX #256-58
  740 JSR inkey
  750 BNE noincc
  760 INC ct
  770 INC ct
  780 JMP start
  790 .noincc
  800 LDX #256-42
  810 JSR inkey
  820 BNE nodecc
  830 DEC ct
  840 DEC ct
  850 JMP start
  860 .nodecc
  870 LDX #0
  880 LDY #0
  890 LDA #129
  900 JSR osbyte
  910 CPY #0
  920 BNE nokey
  930 TXA
  940 AND #&DF
  950 CMP #ASC"Z"
  960 BNE nodeca
  970 DEC aa
  980 RTS
  990 .nodeca
 1000 CMP #ASC"X"
 1010 BNE noinca
 1020 INC aa
 1030 RTS
 1040 .noinca
 1050 CMP #ASC"C"
 1060 BNE nodecb
 1070 DEC bb
 1080 RTS
 1090 .nodecb
 1100 CMP #ASC"V"
 1110 BNE noincb
 1120 INC bb
 1130 RTS
 1140 .noincb
 1150 CMP #ASC"B"
 1160 BNE nodecze
 1170 DEC ze
 1180 RTS
 1190 .nodecze
 1200 CMP #ASC"N"
 1210 BNE noincze
 1220 INC ze
 1230 RTS
 1240 .noincze
 1250 CMP #16
 1260 BNE not0
 1270 LDA #0
 1280 STA ze
 1290 RTS
 1300 .not0
 1310 CMP #25
 1320 BNE not9
 1330 LDA #64
 1340 STA ze
 1350 RTS
 1360 .not9
 1370 .nokey
 1380 LDX #256-113
 1390 JSR inkey
 1400 BEQ esc
 1410 JMP start
 1420 .esc
 1430 RTS
 1440 :
 1450 .inkey
 1460 LDY #&FF
 1470 LDA #129
 1480 JSR osbyte
 1490 CPX #&FF
 1500 RTS
 1510 :
 1520 .plot
 1530 LDA #0
 1540 STA pt
 1550 .plotloop
 1560 JSR point
 1570 INC pt
 1580 BNE plotloop
 1590 RTS
 1600 :
 1610 .point
 1620 LDA at
 1630 STA a
 1640 CLC
 1650 ADC aa
 1660 STA at
 1670 :
 1680 LDA bt
 1690 STA b
 1700 CLC
 1710 ADC bb
 1720 STA bt
 1730 :
 1740 LDA ze
 1750 CLC
 1760 ADC a
 1770 STA d
 1780 :
 1790 \ x=sin(a+b+c)+sin(a+b-c)+sin(a-b+
c)+sin(a-b-c)    cos(d-c)-cos(d+c)
 1800 \     ----------------
-------- - ---------
 1810 \                          4
                          2
 1820 \
 1830 \ (but not needed here!)
 1840 \
 1850 \ y=cos(a-b)-cos(a+b)
 1860 \   ----------
 1870 \            2
 1880 :
 1890 LDA a
 1900 SEC
 1910 SBC b
 1920 TAX
 1930 LDA coslo,X
 1940 STA y
 1950 LDA coshi,X
 1960 STA y+1
 1970 LDA a
 1980 CLC
 1990 ADC b
 2000 TAX
 2010 LDA y
 2020 SEC
 2030 SBC coslo,X
 2040 STA y
 2050 LDA y+1
 2060 SBC coshi,X
 2070 STA y+1
 2080 :
 2090 \ z=cos(a+b-c)-cos(a+b+c)+cos(a-b-
c)-cos(a-b+c)    sin(d+c)+sin(d-c)
 2100 \     ----------------
-------- + ---------
 2110 \                          4
                          2
 2120 :
 2130 LDA a
 2140 CLC
 2150 ADC b
 2160 PHA
 2170 SEC
 2180 SBC ct
 2190 TAX
 2200 LDA coslo,X
 2210 STA z
 2220 LDA coshi,X
 2230 STA z+1
 2240
 2250 PLA
 2260 CLC
 2270 ADC ct
 2280 TAX
 2290 LDA z
 2300 SEC
 2310 SBC coslo,X
 2320 STA z
 2330 LDA z+1
 2340 SBC coshi,X
 2350 STA z+1
 2360 :
 2370 LDA a
 2380 SEC
 2390 SBC b
 2400 PHA
 2410 SEC
 2420 SBC ct
 2430 TAX
 2440 LDA z
 2450 CLC
 2460 ADC coslo,X
 2470 STA z
 2480 LDA z+1
 2490 ADC coshi,X
 2500 STA z+1
 2510 :
 2520 PLA
 2530 CLC
 2540 ADC ct
 2550 TAX
 2560 LDA z
 2570 SEC
 2580 SBC coslo,X
 2590 STA z
 2600 LDA z+1
 2610 SBC coshi,X
 2620 STA z+1
 2630 :
 2640 LDA z+1 \ ASR z...
 2650 ASL A
 2660 ROR z+1
 2670 ROR z
 2680 :
 2690 LDA d
 2700 CLC
 2710 ADC ct
 2720 TAX
 2730 LDA z
 2740 CLC
 2750 ADC sinlo,X
 2760 STA z
 2770 LDA z+1
 2780 ADC sinhi,X
 2790 STA z+1
 2800 :
 2810 LDA d
 2820 SEC
 2830 SBC ct
 2840 TAX
 2850 LDA z
 2860 CLC
 2870 ADC sinlo,X
 2880 STA z
 2890 LDA z+1
 2900 ADC sinhi,X
 2910 STA z+1
 2920 :
 2930 LDA y+1
 2940 LSR A
 2950 ROR y
 2960 LSR A
 2970 ROR y
 2980 LSR A
 2990 ROR y
 3000 LSR A
 3010 ROR y
 3020 LDA #128
 3030 CLC
 3040 ADC y
 3050 STA y
 3060 :
 3070 LDA z+1
 3080 LSR A
 3090 ROR z
 3100 LSR A
 3110 ROR z
 3120 LSR A
 3130 ROR z
 3140 LSR A
 3150 ROR z
 3160 LDA #128
 3170 SEC
 3180 SBC z
 3190 STA z
 3200 :
 3210 LDX pt
 3220 LDA addrlo,X
 3230 STA temp2
 3240 LDA addrhi,X
 3250 STA temp2+1
 3260 LDA bitpos,X
 3270 TAX
 3280 LDA nottab,X
 3290 LDY #0
 3300 AND (temp2),Y
 3310 STA (temp2),Y
 3320 :
 3330 LDA z
 3340 LSR A
 3350 LSR A
 3360 LSR A
 3370 TAX
 3380 LDA z
 3390 AND #7
 3400 STA temp
 3410 LDA y
 3420 AND #255-7
 3430 ORA temp
 3440 CLC
 3450 ADC scrlo,X
 3460 STA temp
 3470 LDA scrhi,X
 3480 ADC #0 \ not y+1!
 3490 STA temp+1
 3500 LDA y
 3510 AND #7
 3520 TAX
 3530 LDA bittab,X
 3540 ORA (temp),Y
 3550 STA (temp),Y
 3560 LDY pt
 3570 LDA temp
 3580 STA addrlo,Y
 3590 LDA temp+1
 3600 STA addrhi,Y
 3610 TXA
 3620 STA bitpos,Y
 3630 .skip
 3640 RTS
 3650 :
 3660 .at EQUB 0
 3670 .bt EQUB 0
 3680 .ct EQUB 240
 3690 .ze EQUB 192
 3700 .rv EQUB 1
 3710 .aa EQUB 3
 3720 .bb EQUB 4
 3730 ]
 3740 scrlo=P%:P%=P%+32
 3750 scrhi=P%:P%=P%+32
 3760 addrlo=P%:P%=P%+256
 3770 addrhi=P%:P%=P%+256
 3780 bitpos=P%:P%=P%+256
 3790 sinlo=P%:P%=P%+2*points
 3800 coslo=sinlo+points/4
 3810 sinhi=P%:P%=P%+2*points
 3820 coshi=sinhi+points/4
 3830 NEXT pass%
 3840 FOR i%=0 TO 7
 3850 i%?bittab=2^(7-i%)
 3860 i%?nottab=255-i%?bittab
 3870 NEXT
 3880 FOR i%=0 TO 31
 3890 a%=&5800+320*i%+32
 3900 scrlo?i%=a% MOD 256
 3910 scrhi?i%=a% DIV 256
 3920 NEXT
 3930 FOR i%=0 TO points-1
 3940 addrlo?i%=&5800 MOD 256
 3950 addrhi?i%=&5800 DIV 256
 3960 bitpos?i%=0
 3970 NEXT
 3980 PRINT"Building tables..."
 3990 FOR i%=0 TO (points*2)-1:REM why 2
?
 4000 v%=&280*SIN(i%*2*PI/points)
 4010 sinlo?i%=v% AND &FF
 4020 sinhi?i%=(v% AND &FF00) DIV &100
 4030 NEXT
 4040 ENDPROC
```

Listing 3

```
   10 REM >SortDemo (Info2a)
   20 REM Different types of sorting
   30 REM By David Lawrence
   40 REM For BBC B/B+/M/C/E/A
   50 REM (c) BAU July 1991
   60 :
   70 MODE 4
   80 VDU 23;8202;0;0;0;
   90 PROCinit
  100 REPEAT
  110 PROCinfo
  120 REPEAT
  130 get$=GET$
  140 n=VALget$
  150 sort=ASCget$-64
  160 IF n>0 AND n<=sizes size = n : PRO
Cinfo
  170 UNTIL sort > 0 AND sort <= sorts
  180 PROCsetarray
  190 dummy = EVAL("FN"+sorts$(sort)+"(1
,"+STR$elems+")")
  200 PROCnewdata(sort,size)
  210 PROCensure
  220 UNTIL FALSE
  230 END
  240 :
  250 DEF PROCinit
  260 READ sorts,sizes
  270 DIM sorts$(sorts)
  280 DIM times(sorts,sizes),comps(sorts
,sizes),moves(sorts,sizes)
  290 DIM array(256),tempa(256),blob(siz
es)
  300 FOR sort = 0 TO sorts
  310 READ sorts$(sort)
  320 FOR size = 1 TO 4
  330 times(sort,size) = -1
  340 comps(sort,size) = -1
  350 moves(sort,size) = -1
  360 NEXT
  370 NEXT
  380 FOR size = 1 TO 4
  390 READ blob(size)
  400 NEXT
  410 size = 3
  420 ENDPROC
  430 :
  440 DATA 6,4
  450 DATA none
  460 DATA bubble,sift,exchange,quick,me
rge,heap
  470 DATA &80,&C0,&F0,&FF
  480 :
  490 DEF PROCinfo
  500 elems = 2^(9 - size)
  510 scale = 2^(size - 1)
  520 VDU 30
  530 PRINT"Sort type";TAB(14);"Comps";T
AB(23);"Moves";TAB(31);"(Time)"
  540 PRINT"-----";TAB(14);"---";T
AB(23);"---";TAB(31);"---"'
  550 FOR sort = 1 TO sorts
  560 PRINT;CHR$(64+sort);") ";FNname(so
rt);TAB(12);FNnum(comps(sort,size));TAB(
21);FNnum(moves(sort,size));TAB(30);FNnu
m(times(sort,size))
  570 NEXT
  580 PRINT'"Size: ";size;"  Elements: "
;elems;"  "''"Select sort (or 1-";sizes;
") :"
  590 ENDPROC
  600 :
  610 DEF FNname(n)
  620 =CHR$(ASCsorts$(n)-32) + MID$(sort
s$(n),2)
  630 :
  640 DEF FNnum(v)
  650 IF v<0 THEN ="  n/a  "
  660 =RIGHT$(STRING$(7," ") + STR$v,7)
  670 :
  680 DEF PROCnewdata(n,s)
  690 times(n,s) = TIME - Time
  700 comps(n,s) = Comps
  710 moves(n,s) = Moves
  720 ENDPROC
  730 :
  740 DEF PROCensure
  750 PRINTTAB(32,29);SPC8;TAB(32,30);SP
C8;TAB(18,28);
  760 FOR loop = 1 TO elems
  770 IF array(loop) <> loop PRINT"Sort
failed!":END
  780 NEXT
  790 PRINT"Data correctly sorted"
  800 ENDPROC
  810 :
  820 DEF PROCsetarray
```

```
830 VDU 23,255
840 FOR i = 8 TO 1 STEP -1
850 IF i <= scale VDU blob(size) ELSE VDU 0
860 NEXT
870 CLS
880 PRINTTAB(33,30);"Making"
890 FOR loop = 1 TO elems
900 array(loop) = loop
910 PROCdota(loop,1)
920 NEXT
930 PRINTTAB(33,30);"Mixing"
940 FOR loop = 1 TO elems
950 PROCswap(loop,RND(elems))
960 NEXT
970 PRINTTAB(32,29);FNname(sort)
980 PRINTTAB(32,30);"Sorting";
990 Comps = 0
1000 Moves = 0
1010 Time = TIME
1020 ENDPROC
1030 :
1040 DEF PROCswap(one,two)
1050 PROCdota(one,0)
1060 PROCdota(two,0)
1070 temp       = array(one)
1080 array(one) = array(two)
1090 array(two) = temp
1100 Moves = Moves + 4
1110 PROCdota(one,1)
1120 PROCdota(two,1)
1130 ENDPROC
1140 :
1150 DEF PROCdota(d,c)
1160 PROCdot(c,d*4,array(d)*4)
1170 ENDPROC
1180 :
1190 DEF PROCdott(d,c)
1200 PROCdot(c,d*4,tempa(d)*4)
1210 ENDPROC
1220 :
1230 DEF PROCdot(c,x,y)
1240 GCOL 0,c
1250 IF size = 1 PLOT 69,x-4,y-4:ENDPROC
1260 MOVE (x-4)*scale,(y-4)*scale+31:VDU 5,255,4
1270 ENDPROC
1280 :
1290 :
1300 REM Sort routines from here...
1310 :
1320 DEF FNbubble(from,to)
1330 REPEAT
1340 sorted = TRUE
1350 FOR bubble = from TO to - 1
1360 Moves = Moves + 2
1370 Comps = Comps + 1
1380 IF array(bubble+1) < array(bubble) PROCswap(bubble,bubble+1) : sorted = FALSE
1390 NEXT
1400 UNTIL sorted
1410 =0
1420 :
1430 DEF FNsift(from,to)
1440 REPEAT
1450 sorted = TRUE
1460 FOR sift = to TO from + 1 STEP -1
1470 Moves = Moves + 1
1480 Comps = Comps + 1
1490 IF array(sift) < array(sift-1) PROCsiftin(sift) : sorted = FALSE
1500 NEXT
1510 UNTIL sorted
1520 =0
1530 :
1540 DEF PROCsiftin(top)
1550 value = array(top)
1560 Moves = Moves + 1
1570 PROCdota(top,0)
1580 pos = top
1590 REPEAT
1600 found = TRUE
1610 pos = pos - 1
1620 IF array(pos) > value PROCshuffle
1630 Moves = Moves + 1
1640 Comps = Comps + 1
1650 UNTIL found OR pos = 0
1660 array(pos+1) = value
1670 Moves = Moves + 1
1680 PROCdota(pos+1,1)
1690 ENDPROC
1700 :
1710 DEF PROCshuffle
1720 PROCdota(pos,0)
1730 array(pos+1) = array(pos)
1740 PROCdota(pos+1,1)
1750 Moves = Moves + 2
1760 found = FALSE
1770 ENDPROC
1780 :
1790 DEF FNexchange(from,to)
1800 FOR slow1 = from TO to
1810 lowest = slow1
1820 FOR slow2 = slow1 TO to
1830 Comps = Comps + 1
1840 Moves = Moves + 2
1850 IF array(slow2) < array(lowest) lowest = slow2
1860 NEXT
1870 PROCswap(slow1,lowest)
1880 NEXT
1890 =0
1900 :
1910 DEF FNquick(from,to)
1920 quick1 = from - 1
1930 quick2 = to + 1
1940 pivot = array((from + to) / 2)
1950 Moves = Moves + 1
1960 REPEAT
1970 REPEAT
1980 Comps = Comps + 1
1990 quick1 = quick1 + 1
2000 UNTIL array(quick1) >= pivot
2010 REPEAT
2020 Comps = Comps + 1
2030 quick2 = quick2 - 1
2040 UNTIL array(quick2) <= pivot
2050 IF quick1 <= quick2 PROCswap(quick1,quick2)
2060 UNTIL quick1 > quick2
2070 IF quick1 < to x=FNquick(quick1,to)
2080 IF quick2 > from x=FNquick(from,quick2)
2090 =0
2100 :
2110 DEF FNmerge(from,to)
2120 LOCAL mid
2130 IF from >= to THEN =0
2140 mid = (from + to) DIV 2
2150 x=FNmerge(from,mid)
2160 x=FNmerge(mid+1,to)
2170 PROCmrg(from,mid,mid+1,to)
2180 =0
2190 :
2200 DEF PROCmrg(from1,to1,from2,to2)
2210 FOR i = from1 TO to1
2220 tempa(i) = array(i)
2230 Moves = Moves + 2
2240 NEXT
2250 place = from1
2260 REPEAT
2270 Moves = Moves + 2
2280 Comps = Comps + 1
2290 IF tempa(from1) < array(from2) PROCusetempa ELSE PROCusearray
2300 PROCdota(place,1)
2310 Comps = Comps + 1
2320 Moves = Moves + 1
2330 place = place + 1
2340 UNTIL from1 > to1 OR from2 > to2
2350 IF from1 > to1 ENDPROC
2360 FOR i = from1 TO to1
2370 PROCdott(i,0)
2380 array(place) = tempa(i)
2390 PROCdota(place,1)
2400 place = place + 1
2410 Moves = Moves + 2
2420 NEXT
2430 ENDPROC
2440 :
2450 DEF PROCusetempa
2460 PROCdott(from1,0)
2470 array(place) = tempa(from1)
2480 Moves = Moves + 2
2490 from1 = from1 + 1
2500 ENDPROC
2510 :
2520 DEF PROCusearray
2530 PROCdota(from2,0)
2540 array(place) = array(from2)
2550 Moves = Moves + 2
2560 from2 = from2 + 1
2570 ENDPROC
2580 :
2590 DEF FNheap(x,count)
2600 node = (count DIV 2) + 1
2610 REPEAT
2620 IF node = 1 PROCmoveroot ELSE PROCmakeheap
2630 IF count <> 1 PROCinsert(node,value)
2640 UNTIL count = 1
2650 array(1) = value
2660 Moves = Moves + 1
2670 =0
2680 :
2690 DEF PROCmoveroot
2700 PROCdota(count,0)
2710 value = array(count)
2720 PROCdota(1,0)
2730 array(count) = array(1)
2740 PROCdota(count,1)
2750 Moves = Moves + 2
2760 count = count - 1
2770 ENDPROC
2780 :
2790 DEF PROCmakeheap
2800 node = node - 1
2810 PROCdota(node,0)
2820 value = array(node)
2830 Moves = Moves + 1
2840 ENDPROC
2850 :
2860 DEF PROCinsert(parent,value)
2870 REPEAT
2880 done = TRUE
2890 child = parent * 2
2900 IF child <= count PROCcheckchild
2910 UNTIL done
2920 array(parent) = value
2930 PROCdota(parent,1)
2940 Moves = Moves + 1
2950 Comps = Comps + 1
2960 ENDPROC
2970 :
2980 DEF PROCcheckchild
2990 IF child < count PROCchecksibling
3000 IF value < array(child) PROCmovechild
3010 Moves = Moves + 1
3020 Comps = Comps + 1
3030 ENDPROC
3040 :
3050 DEF PROCchecksibling
3060 IF array(child) < array(child + 1) child = child + 1
3070 Moves = Moves + 2
3080 Comps = Comps + 1
3090 ENDPROC
3100 :
3110 DEF PROCmovechild
3120 PROCdota(child,0)
3130 array(parent) = array(child)
3140 PROCdota(parent,1)
3150 Moves = Moves + 2
3160 parent = child
3170 done = FALSE
3180 ENDPROC
```

Listing 4

```
10 REM >Heaping (Info2b)
20 REM By David Lawrence
30 REM For BBC B/B+/M/C/E/A
40 REM (c) BAU July 1991
50 :
60 MODE 1
70 VDU 23;8202;0;0;0;
80 PROCinit
90 PROCgettree
100 PROCmakeheap(root)
110 CLS
120 PROCinform(20,"Converted to heap")
130 PROCdrawtree(root)
140 PROCspace
150 PROCsortheap(root)
160 CLS
170 PROCdrawtree(NULL)
180 PROCshowout
190 PROCinform(20,"Data sorted")
200 COLOUR 3
210 VDU 30
220 END
230 :
240 DEF PROCinit
250 max_nodes = 15
260 nodes = 0
270 Value = 0
280 Left  = 4
290 Right = 8
300 node_size = 12
310 DIM tree max_nodes * node_size
320 NULL = 0
330 mem_ptr = tree
340 root = NULL
350 boxsize = 36
360 out$ = ""
370 ENDPROC
380 :
390 DEF PROCgettree
400 REPEAT
410  PROCdrawtree(root)
420  PRINTTAB(7,30);"     "
430  INPUTTAB(0,30);"Data : "v$
440  IF v$ <> "" PROCnewnode(VALv$)
450 UNTIL v$ = "" OR nodes = 15
460 IF nodes > 0 ENDPROC
470 PRINTTAB(0,30);"        "
480 FOR i = 1 TO 7+RND(8)
490   PROCnewnode(RND(99))
500 NEXT
510 PROCdrawtree(root)
520 PROCinform(20,"Created random tree")
530 PROCspace
540 ENDPROC
550 :
560 DEF PROCnewnode(v)
570 new = FNaddnode(root,v)
580 IF root = NULL root = new
590 nodes = nodes + 1
600 ENDPROC
610 :
620 DEF PROCinform(line,a$)
630 COLOUR 2
640 PRINTTAB(0,line);SPC40;TAB((40-LEN(a$))/2,line);a$
650 ENDPROC
660 :
670 DEF PROCspace
680 COLOUR 3
690 PRINTTAB(8,31);"Press SPACE to continue";
700 IFGET
710 PRINTTAB(8,31);STRING$(23," ");
720 ENDPROC
730 :
740 DEF PROCshowout
750 COLOUR 3
760 PRINTTAB(0,27);"Out: ";
770 COLOUR 1
780 cur = 1
790 REPEAT
800   spc = INSTR(out$," ",cur)
810   PRINTRIGHT$("    "+MID$(out$,cur,spc-cur),4);
820   IF POS > 36 PRINT'TAB(5);
830   cur = spc + 1
840 UNTIL cur > LEN(out$)
850 ENDPROC
860 :
870 DEF FNnewnode(v)
880 mem_ptr!Value = v
890 mem_ptr!Left = NULL
900 mem_ptr!Right = NULL
910 mem_ptr = mem_ptr + node_size
920 = mem_ptr - node_size
930 :
940 DEF PROCdrawtree(tree)
950 VDU 5
960 PROCdrawnode(tree,640,320,1023-boxsize)
970 VDU 4
980 ENDPROC
990 :
1000 DEF PROCdrawnode(node,x,w,y)
1010 GCOL 0,1
1020 IF node <> NULL MOVE x-w,y-128 : DRAW x,y : DRAW x+w,y-128
1030 PROCbox(x-boxsize,y-boxsize,x+boxsize,y+boxsize,0,2)
1040 GCOL 0,3
1050 IF node = NULL MOVE x-boxsize,y-boxsize:DRAW x+boxsize,y+boxsize:MOVE x-boxsize,y+boxsize:DRAW x+boxsize,y-boxsize:ENDPROC
1060 n$=STR$(node!Value)
1070 MOVE x-(LENn$*32/2),y+boxsize/2-4:PRINTn$
1080 PROCdrawnode(node!Left,x-w,w/2,y-128)
1090 PROCdrawnode(node!Right,x+w,w/2,y-128)
1100 ENDPROC
1110 :
1120 DEF PROCbox(x1,y1,x2,y2,b,f)
1130 IF b>=0 VDU 24,x1;y1;x2;y2;18,0,b,16,26
1140 GCOL 0,f
1150 MOVE x1,y1:DRAW x1,y2:DRAW x2,y2:DRAW x2,y1:DRAW x1,y1
1160 ENDPROC
1170 :
1180 DEF FNaddnode(tree,val)
1190 new = FNnewnode(val)
1200 IF tree = NULL THEN =new
1210 REPEAT
1220   tree = FNchecktree(tree)
1230 UNTIL tree = NULL
1240 =NULL
1250 :
1260 DEF FNchecktree(tree)
1270 ld = FNfindleaf(tree!Left,0)
1280 rd = FNfindleaf(tree!Right,0)
1290 IF ld = 0 tree!Left = new : =NULL
1300 IF rd = 0 tree!Right = new : =NULL
1310 IF ld <= rd THEN =tree!Left
1320 =tree!Right
1330 :
1340 DEF FNfindleaf(node,level)
1350 IF node = NULL THEN =level
1360 IF node!Left = NULL OR node!Right = NULL THEN =level+1
1370 LOCAL left_level,right_level
1380 left_level  = FNfindleaf(node!Left,level+1)
1390 right_level = FNfindleaf(node!Right,level+1)
1400 IF left_level <= right_level THEN =left_level
1410 =right_level
1420 :
1430 DEF PROCmakeheap(tree)
1440 IF tree = NULL ENDPROC
1450 max = FNhighest(tree)
1460 temp = tree!Value
1470 tree!Value = max!Value
1480 max!Value = temp
1490 PROCmakeheap(tree!Left)
1500 PROCmakeheap(tree!Right)
1510 ENDPROC
1520 :
1530 DEF FNhighest(node)
1540 LOCAL high
1550 high = node
1560 PROCcheck(Left)
1570 PROCcheck(Right)
1580 =high
1590 :
1600 DEF PROCcheck(dir)
1610 IF node!dir = NULL ENDPROC
1620 this = FNhighest(node!dir)
1630 IF this!Value > high!Value high = this
1640 ENDPROC
1650 :
1660 DEF PROCsortheap(heap)
1670 IF heap = NULL ENDPROC
1680 REPEAT
1690   v$ = STR$(heap!Value)
1700   out$ = v$ + " " + out$
1710   PROCinform(20,"Removing root ("+v$+")")
1720   PROCshowout
1730 UNTIL FNheapdone
1740 ENDPROC
1750 :
1760 DEF FNheapdone
1770 IF heap!Left = NULL AND heap!Right = NULL THEN PROCspace:=TRUE
1780 rightaddr = FNrightmost(heap)
1790 rightptr = !rightaddr
1800 rightval = rightptr!Value
```

►

```
1810 !rightaddr = NULL
1820 heap!Value = rightval
1830 PROCinform(22,"Replacing with righ
tmost ("+STR$rightval+")")
1840 PROCspace
1850 CLS
1860 PROCshowout
1870 PROCdrawtree(heap)
1880 PROCinform(20,"Converting back to
heap...")
1890 PROCspace
1900 PROCmakeheap(heap)
1910 PROCdrawtree(heap)
1920 =FALSE
1930 :
1940 DEF FNrightmost(tree)
1950 IF tree = NULL THEN =NULL
1960 ld = FNdepth(tree!Left)
1970 rd = FNdepth(tree!Right)
1980 IF ld = 1 AND rd = 0 THEN =tree +
Left
1990 IF ld = 1 AND rd = 1 THEN =tree +
Right
2000 IF ld = rd THEN =FNrightmost(tree!
Right)
2010 =FNrightmost(tree!Left)
2020 :
2030 DEF FNdepth(node)
2040 IF node = NULL THEN =0
2050 LOCAL left_depth,right_depth
2060 left_depth  = FNdepth(node!Left) +
1
2070 right_depth = FNdepth(node!Right)
+ 1
2080 IF left_depth > right_depth THEN =
left_depth
2090 =right_depth
```

Listing 5

```
  10 REM >Heap8 (Info2c)
  20 REM eight-bit heap sort
  30 REM by Dave Acton
  40 REM for B/B+/E/M/C
  50 REM (c) BAU July 1991
  60 :
  70 MODE 0
  80 objects%=100
  90 maxlen%=10
 100 DIM wk% objects%*maxlen%
 110 DIM loptr% objects%,hiptr% objects
%
 120 DIM code% &100
 130 :
 140 addr1 =&70
 150 addr2 =&72
 160 curlo =&74
 170 curhi =&75
 180 node  =&76
 190 count =&77
 200 child =&78
 210 parent=&79
 220 :
 230 FOR pass%=0 TO 2 STEP 2
 240 P%=code%
 250 [OPT pass%
 260 .sort
 270 STA count
 280 LSR A
 290 STA node
 300 INC node
 310 .sortloop
 320 LDY node
 330 CPY #1
 340 BNE nodenot1
 350 LDX count
 360 LDA loptr%-1,X
 370 STA curlo
 380 LDA hiptr%-1,X
 390 STA curhi
 400 LDA loptr%
 410 STA loptr%-1,X
 420 LDA hiptr%
 430 STA hiptr%-1,X
 440 DEX
 450 STX count
 460 CPX #1
 470 BNE sort2
 480 LDA curlo
 490 STA loptr%
 500 LDA curhi
 510 STA hiptr%
 520 JMP sort2
 530 .nodenot1
 540 DEY
 550 STY node
 560 LDA loptr%-1,Y
 570 STA curlo
 580 LDA hiptr%-1,Y
 590 STA curhi
 600 .sort2
 610 LDA count
 620 CMP #1
 630 BNE notdonesort
 640 RTS
 650 .notdonesort
 660 STY child
 670 .sortloop2
 680 LDA child
 690 STA parent
 700 ASL A
 710 STA child
 720 BCS storecur
 730 CMP count
 740 BEQ nocheck
 750 BCS storecur
 760 LDX child
 770 LDA loptr%-1,X
 780 STA addr1
 790 LDA hiptr%-1,X
 800 STA addr1+1
 810 LDA loptr%,X
 820 STA addr2
 830 LDA hiptr%,X
 840 STA addr2+1
 850 JSR compare
 860 BCS nocheck
 870 INC child
 880 .nocheck
 890 LDA curlo
 900 STA addr1
 910 LDA curhi
 920 STA addr1+1
 930 LDX child
 940 LDA loptr%-1,X
 950 STA addr2
 960 LDA hiptr%-1,X
 970 STA addr2+1
 980 JSR compare
 990 BCS storecur
1000 LDY parent
1010 LDA loptr%-1,X
1020 STA loptr%-1,Y
1030 LDA hiptr%-1,X
1040 STA hiptr%-1,Y
1050 JMP sortloop2
1060 .storecur
1070 LDX parent
1080 LDA curlo
1090 STA loptr%-1,X
1100 LDA curhi
1110 STA hiptr%-1,X
1120 JMP sortloop
1130 :
1140 .compare
1150 LDY #0
1160 .compareloop
1170 LDA (addr1),Y
1180 CMP (addr2),Y
1190 BCC compared
1200 BNE compared
1210 INY
1220 CPY #maxlen%
1230 BNE compareloop
1240 .compared
1250 RTS
1260 ]
1270 NEXT pass%
1280 PRINT"Bytes used=";P%-code%
1290 PRINT'"Building random words:"'
1300 FOR i%=0 TO objects%-1
1310 a%=wk%+i%*maxlen%
1320 $a%=FNrandword
1330 PROCdispword($a%,i%=objects%-1)
1340 loptr%?i%=a% MOD 256
1350 hiptr%?i%=a% DIV 256
1360 NEXT
1370 A%=objects%
1380 TIME=0
1390 CALL sort
1400 t%=TIME
1410 PRINT''"Sorted in ";t%;" centiseco
nds:"'
1420 FOR i%=0 TO objects%-1
1430 a%=loptr%?i%+256*hiptr%?i%
1440 PROCdispword($a%,i%=objects%-1)
1450 NEXT
1460 END
1470 :
1480 DEF PROCdispword(w$,last%)
1490 PRINT w$;
1500 IF NOT last% PRINT",";
1510 IF POS>78-maxlen% PRINT
1520 ENDPROC
1530 :
1540 DEF FNrandword
1550 r$=""
1560 cons%=TRUE
1570 count%=0
1580 REPEAT
1590 IF cons% PROCconsonant ELSE PROCvo
wel
1600 UNTIL LEN(r$)=maxlen%-1 OR (LEN(r$
)>3 AND RND(5)=5)
1610 =r$
1620 :
1630 DEF PROCconsonant
1640 r$=r$+MID$("BCDFGHJKLMNPQRSTVWXYZ"
,RND(21),1)
1650 count%=count%+1
1660 IF count%=2 OR RND(3)<3 cons%=NOT
cons%:count%=0
1670 ENDPROC
1680 :
1690 DEF PROCvowel
1700 r$=r$+MID$("AEIOU",RND(5),1)
1710 cons%=NOT cons%
1720 ENDPROC
```

Listing 6

```
  10 REM >OSHeapDemo (Info2d)
  20 REM 32 Bit heap sort
  30 REM By David Lawrence
  40 REM For Archimedes only
  50 REM (c) BAU July 1991
  60 :
  70 MODE 0
  80 number = 10000
  90 DIM memory number*8,pointers numbe
r*4
 100 PROCassemble
 110 PROCdemo
 120 END
 130 :
 140 DEF PROCassemble
 150 n_bit% = 1<<31
 160 v_bit% = 1<<28
 170 link = 14
 180 pc = 15
 190 DIM code 100
 200 FOR pass = 0 TO 2 STEP 2
 210 P% = code
 220 [OPT pass
 230 .compare
 240 LDR     R2,[R0,#4]
 250 LDR     R3,[R1,#4]
 260 CMP     R2,R3
 270 BEQ     checkbottom
 280 CMP     R2,R3
 290 BICCSS  pc,link,#(n_bit% OR v_bit%
)
 300 BIC     link,link,#v_bit%
 310 ORRS    pc,link,#n_bit%
 320 .checkbottom
 330 LDR     R2,[R0]
 340 LDR     R3,[R1]
 350 CMP     R2,R3
 360 BICCSS  pc,link,#(n_bit% OR v_bit%
)
 370 BIC     link,link,#v_bit%
 380 ORRS    pc,link,#n_bit%
 390 ]NEXT
 400 ENDPROC
 410 :
 420 DEF PROCdemo
 430 FOR i = 0 TO number - 1
 440 memory!(i*8+4) = RND
 450 memory!(i*8) = RND
 460 NEXT
 470 PRINT"Before sorting... (Selection
 of 10)"'
 480 FOR i = 0 TO 9
 490 PRINTFNnum(i*number/10)
 500 NEXT
 510 time%=TIME
 520 SYS "OS_HeapSort",number,pointers
OR (%11 << 30),compare,,memory,8
 530 time%=TIME-time%
 540 PRINT'"After sorting... (Selection
 of 10)"'
 550 FOR i = 0 TO 9
 560 PRINTFNnum(i*number/10)
 570 NEXT
 580 PRINT'"Time taken: ";time%/100
 590 ENDPROC
 600 :
 610 DEF FNnum(n)
 620 PRINT"   ";FNhex(memory!(n*8+4));F
Nhex(memory!(n*8));
 630 =""
 640 :
 650 DEF FNhex(dec)
 660 =RIGHT$("00000000"+STR$~dec,8)
```

Listing 7

```
  10 REM >Squiggle (Info3a)
  20 REM Pipe Game
  30 REM by Barry Wickett
  40 REM for Archimedes only
  50 REM (c) BAU July 1991
  60 :
  70 PROCsetup
  80 REPEAT
  90 player%=3-player%
 100 PROCplay
 110 UNTIL winner%>0
 120 VDU 4
 130 COLOUR 1
 140 PRINTTAB(12,30);" Player ";winner%
;" won! "
 150 END
 160 :
 170 DEF PROCplay
 180 rx%=FNord(x%)
 190 ry%=FNord(y%)
 200 GCOL 3,3
 210 RECTANGLE FILL rx%,ry%,96,96
 220 MOVE BY -60,-32
 230 VDU 48+player%
 240 REPEAT
 250 key%=GET-48
 260 UNTIL key%>=1 AND key%<=3
 270 PROCdraw(FNord(x%),FNord(y%),key%)
 280 board%(x%,y%)=key%
 290 REPEAT
 300 pd%=entrance(board%(x%,y%),pd%)
 310 x%+=ix%(pd%)
 320 y%+=iy%(pd%)
 330 UNTIL board%(x%,y%)=0 OR x%<1 OR y
%<1 OR x%>8 OR y%>8
 340 IF (x%=8 AND y%=9) OR (x%=9 AND y%
=9) THEN
 350 winner%=player%
 360 ELSE
 370 IF x%<1 OR y%<1 OR x%>8 OR y%>8 TH
EN winner%=3-player%
 380 ENDIF
 390 ENDPROC
 400 :
 410 DEF PROCsetup
 420 MODE 1
 430 PROCreset
 440 COLOUR 0,0,100,100
 450 COLOUR 1,200,200,200
 460 COLOUR 2,0,0,100
 470 COLOUR 3,200,0,0
 480 player%=2:winner%=0
 490 x%=2:y%=1:pd%=4
 500 DIM board%(9,9),ix%(4),iy%(4),entr
ance(3,4)
 510 FOR dir=1 TO 4
 520 READ ix%(dir),iy%(dir)
 530 NEXT dir
 540 FOR piece=1 TO 3
 550 FOR entrance=1 TO 4
 560 READ entrance(piece,entrance)
 570 NEXT entrance
 580 NEXT piece
 590 board%(1,1)=2:board%(8,8)=2
 600 FOR x=1 TO 8
 610 FOR y=1 TO 8
 620 PROCdraw(FNord(x),FNord(y),board%(
x,y))
 630 NEXT y
 640 NEXT x
 650 RECTANGLE 96,96,804,804
 660 GCOL 0,2
 670 RECTANGLE 92,92,812,812
 680 FOR piece=1 TO 3
 690 px%=FNord(.5+piece*2)
 700 py%=-12
 710 PROCdraw(px%,py%,piece)
 720 GCOL 0,3
 730 MOVE px%+42,py%-32
 740 VDU 5,48+piece
 750 GCOL 0,1
 760 MOVE BY -36,4
 770 VDU 5,48+piece
 780 NEXT piece
 790 ENDPROC
 800 :
 810 DEF PROCreset
 820 VDU 26
 830 ORIGIN 124,100
 840 ENDPROC
 850 :
 860 DEF FNord(a)=(a*100) ANDNOT3
 870 :
 880 DEF PROCdraw(rx,ry,piece)
 890 VDU 24,rx;ry;rx+96;ry+96;
 900 GCOL 0,1
 910 RECTANGLE FILL rx,ry,96,96
 920 GCOL 0,2
 930 RECTANGLE rx,ry,96,96
 940 GCOL 0,3
 950 FOR ix=0 TO 4 STEP 4
 960 FOR iy=0 TO 4 STEP 4
 970 CASE piece OF
 980 WHEN 1:
 990 CIRCLE rx+ix,ry+iy,50
1000 CIRCLE rx+ix+96,ry+iy+96,50
1010 WHEN 2:
1020 LINE rx+ix,ry+iy+50,rx+ix+100,ry+i
y+50
1030 LINE rx+ix+50,ry+iy,rx+ix+50,ry+iy
+100
1040 WHEN 3:
1050 CIRCLE rx+ix+96,ry+iy,50
1060 CIRCLE rx+ix,ry+iy+96,51
1070 ENDCASE
1080 NEXT iy
1090 NEXT ix
1100 PROCreset
1110 ENDPROC
1120 :
1130 DATA 0,-1,-1,0,0,1,1,0
1140 DATA 4,3,2,1
1150 DATA 1,2,3,4
1160 DATA 2,1,4,3
```

Listing 8

```
  10 REM >Squig8 (Info3b)
  20 REM Original by Barry Wickett
  30 REM 8-bit version by Dave Acton
  40 REM for B/B+/E/M/C/A
  50 REM (c) BAU July 1991
  60 :
  70 ON ERROR MODE 0:REPORT:PRINT" at l
ine ";ERL:END
  80 MODE 1
  90 PROCsetup
 100 REPEAT
 110 player%=3-player%
 120 PROCplay
 130 UNTIL winner%>0
 140 VDU 4
 150 COLOUR 3
 160 PRINTTAB(12,30);" Player ";winner%
;" won! "
 170 END
 180 :
 190 DEF PROCplay
 200 rx%=FNord(x%)
 210 ry%=FNord(y%)
 220 GCOL 0,2
 230 PROCrectfill(rx%,ry%,96,96)
 240 GCOL 0,3
 250 MOVE rx%+36,ry%+64
 260 VDU 48+player%
 270 REPEAT
 280 key%=GET-48
 290 UNTIL key%>=1 AND key%<=3
```

```
 300 PROCdraw(FNord(x%),FNord(y%),key%)
 310 board%(x%,y%)=key%
 320 REPEAT
 330 pd%=entrance(board%(x%,y%),pd%)
 340 x%=x%+ix%(pd%)
 350 y%=y%+iy%(pd%)
 360 UNTIL board%(x%,y%)=0 OR x%<1 OR y
%<1 OR x%>8 OR y%>8
 370 IF (x%=8 AND y%=9) OR (x%=9 AND y%
=9) THEN winner%=player%:ENDPROC
 380 IF x%<1 OR y%<1 OR x%>8 OR y%>8 TH
EN winner%=3-player%
 390 ENDPROC
 400 :
 410 DEF PROCsetup
 420 VDU 19,0,4,0,0,0
 430 VDU 19,2,0,0,0,0
 440 VDU 5
 450 PROCreset
 460 player%=2:winner%=0
 470 x%=2:y%=1:pd%=4
 480 DIM board%(9,9),ix%(4),iy%(4),entr
ance(3,4)
 490 FOR dir=1 TO 4
 500 READ ix%(dir),iy%(dir)
 510 NEXT dir
 520 FOR piece=1 TO 3
 530 FOR entrance=1 TO 4
 540 READ entrance(piece,entrance)
 550 NEXT entrance
 560 NEXT piece
 570 FOR c%=128 TO 143
 580 VDU 23,c%
 590 FOR d%=0 TO 7
 600 READ b%
 610 VDU b%
 620 NEXT
 630 NEXT
 640 board%(1,1)=2:board%(8,8)=2
 650 FOR x=1 TO 8
 660 FOR y=1 TO 8
 670 PROCdraw(FNord(x),FNord(y),board%(
x,y))
 680 NEXT y
 690 NEXT x
 700 PROCrect(96,96,804,804)
 710 GCOL 0,2
 720 PROCrect(92,92,812,812)
 730 FOR piece=1 TO 3
 740 px%=FNord(.5+piece*2)
 750 py%=-12
 760 PROCdraw(px%,py%,piece)
 770 GCOL 0,2
 780 MOVE px%+40,py%-32
 790 VDU 48+piece
 800 GCOL 0,3
 810 MOVE px%+36,py%-28
 820 VDU 48+piece
 830 NEXT piece
 840 ENDPROC
 850 :
 860 DEF PROCreset
 870 VDU 26,29,124;100;
 880 ENDPROC
 890 :
 900 DEF FNord(a)=(a*100) AND (NOT 3)
 910 :
 920 DEF PROCdraw(rx,ry,piece)
 930 VDU 24,rx;ry;rx+96;ry+96;
 940 GCOL 0,129
 950 CLG
 960 GCOL 0,2
 970 PROCrect(rx,ry,96,96)
 980 GCOL 0,3
 990 IF piece=1 PROCtype1
1000 IF piece=2 PROCtype2
1010 IF piece=3 PROCtype3
1020 PROCreset
1030 ENDPROC
1040 :
1050 DEF PROCcircle(x,y)
1060 LOCAL i%,j%
1070 FOR i%=0 TO 3
1080 FOR j%=0 TO 3
1090 MOVE x-64+32*j%,y+63-32*i%
1100 VDU 128+j%+4*i%
1110 NEXT
1120 NEXT
1130 ENDPROC
1140 :
1150 DEF PROCtype1
1160 PROCcircle(rx,ry)
1170 PROCcircle(rx+96,ry+96)
1180 ENDPROC
1190 :
1200 DEF PROCtype2
1210 PROCrectfill(rx,ry+50-4,100,8)
1220 PROCrectfill(rx+50-4,ry,8,100)
1230 ENDPROC
1240 :
1250 DEF PROCtype3
1260 PROCcircle(rx+96,ry)
1270 PROCcircle(rx,ry+96)
1280 ENDPROC
1290 :
1300 DEF PROCrect(x%,y%,w%,h%)
1310 MOVE x%,y%
1320 DRAW x%+w%,y%
1330 DRAW x%+w%,y%+h%
1340 DRAW x%,y%+h%
1350 DRAW x%,y%
1360 ENDPROC
1370 :
1380 DEF PROCrectfill(x%,y%,w%,h%)
1390 MOVE x%,y%
1400 MOVE x%+w%,y%
1410 PLOT 85,x%,y%+h%
1420 PLOT 85,x%+w%,y%+h%
1430 ENDPROC
1440 :
1450 DATA 0,-1,-1,0,0,1,1,0
1460 DATA 4,3,2,1
1470 DATA 1,2,3,4
1480 DATA 2,1,4,3
1490 :
1500 DATA 0,0,0,0,0,1,3,3
1510 DATA 0,0,7,63,127,248,224,192
1520 DATA 0,0,240,254,255,15,3,1
1530 DATA 0,0,0,0,0,192,224,224
1540 DATA 7,15,14,14,28,28,28,28
1550 DATA 128,0,0,0,0,0,0,0
1560 DATA 0,0,0,0,0,0,0,0
1570 DATA 240,120,56,56,28,28,28,28
1580 DATA 28,28,28,14,14,15,7,3
1590 DATA 0,0,0,0,0,0,128,192
1600 DATA 0,0,0,0,0,0,0,1
1610 DATA 28,28,28,56,56,120,240,224
1620 DATA 3,1,0,0,0,0,0,0
1630 DATA 224,248,127,63,7,0,0,0
1640 DATA 3,15,255,254,240,0,0,0
1650 DATA 224,192,0,0,0,0,0,0
```

Listing 9

```
  10 REM >GrabSpr (Info4)
  20 REM by Dave Acton
  30 REM for Archimedes only
  40 REM (c) BAU July 1991
  50 :
  60 SYS "Wimp_BaseOfSprites" TO base1%
,base2%
  70 PROCsave("ROM",base1%)
  80 PROCsave("RAM",base2%)
  90 END
 100 :
 110 DEF PROCsave(which$,base%)
 120 REPEAT
 130  PRINT"Save "which$" sprites as: "
;
 140  INPUT""file$
 150  SYS "XOS_SpriteOp",256+12,base%,f
ile$ TO ;ok%
 160 UNTIL (ok% AND 1)=0
 170 ENDPROC
```

GameCore

Listing 1

```
  10 REM >!RunImage (GameCore1)
  20 REM GameCore Demo
  30 REM by Adam Broges
  40 REM for Archimedes only
  50 REM (c) BAU July 1991
  60 :
  70 MODE 12
  80 OFF
  90 FOR c%=0 TO 3
 100 COLOUR c%,0
 110 NEXT
 120 COLOUR 8,1
 130 *POINTER
 140 *RMLOAD <GameCore$Dir>.GameCore
 150 :
 160 PROCmaininit
 170 gameno%=0
 180 f$(gameno%)="td"
 190 LIBRARY("<GameCore$Dir>."+f$(gamen
o%))
 200 info%(gameno%)=FNgetablock(128)
 210 z%=FNfunc(gameno%,"init")
 220 best%(gameno%)=FNgetablock(info%(g
ameno%)?55)
 230 info%(gameno%)!56=best%(gameno%)
 240 ss%=&100+info%(gameno%)!32*info%(g
ameno%)!36/8
 250 s%(gameno%)=FNgetablock(ss%)
 260 !s%(gameno%)=ss%
 270 s%(gameno%)!4=0
 280 s%(gameno%)!8=16
 290 s%(gameno%)!12=16
 300 SYS "OS_SpriteOp",15+256,s%(gameno
%),"board",0,info%(gameno%)!32/2,info%(g
ameno%)!36/4,12
 310 SYS "GameCore_Init",info%(gameno%)
 TO inst1%
 320 spare%(gameno%)=!info%(gameno%)+in
fo%(gameno%)!40
 330 control(gameno%,0)=1
 340 control(gameno%,1)=0
 350 timepermove(gameno%,0)=200
 360 timepermove(gameno%,1)=200
 370 step(gameno%,0)=2
 380 step(gameno%,1)=2
 390 player%(gameno%)=0
 400 starts%(gameno%)=0
 410 game%=1
 420 :
 430 REPEAT
 440 CLS
 450 PROCc("GameCore - Demo Version",2)
 460 PROCc("3-D Noughts & Crosses",4)
 470 turn%(gameno%)=0
 480 last(gameno%,0)=info%(gameno%)?52
 490 last(gameno%,1)=info%(gameno%)?52
 500 timeforlast()=10
 510 z%=FNfunc(gameno%,"newgame")
 520 PROCpreserveboard(gameno%)
 530 z%=FNfunc(gameno%,"showboard")
 540 status%(gameno%)=stat_prethink%
 550 player%(gameno%)=starts%(gameno%)
 560 moves%(gameno%,0)=0
 570 moves%(gameno%,1)=0
 580 gameover%(gameno%)=FALSE
 590 stale%(gameno%)=0
 600 :
 610 REPEAT
 620 CASE status%(gameno%) OF
 630 WHEN stat_prethink%:
 640 tt%=TIME
 650 info%(gameno%)?60=player%(gameno%)
 660 SYS "GameCore_Stale",player%(gamen
o%),,inst1% TO z%
 670 IF z% THEN
 680 stale%(gameno%)+=1
 690 status%(gameno%)=stat_postmove%
 700 ELSE
 710 stale%(gameno%)=0
 720 CASE control(gameno%,player%(gamen
o%)) OF
 730 WHEN 0:PROCinitcomputermove(gameno
%,player%(gameno%))
 740 WHEN 1:PROCinitplayermove(gameno%,
player%(gameno%))
 750 ENDCASE
 760 status%(gameno%)=stat_think%
 770 z%=FNfunc(gameno%,"listmoves")
 780 ENDIF
 790 IF control(gameno%,player%(gameno%
))=0 PROCc("Thinking... ",6) ELSE PROCc(
"Your move...",6)
 800 WHEN stat_think%:
 810 CASE control(gameno%,player%(gamen
o%)) OF
 820 WHEN 0:
 830 done%=FNgetcomputermove(gameno%,pl
ayer%(gameno%))
 840 z%=FNpassonclicks(gameno%,who%,"id
le")
 850 WHEN 1:
 860 done%=FNpassonclicks(gameno%,playe
r%(gameno%),"getmove")
 870 ENDCASE
 880 IF done% THEN
 890 CASE control(gameno%,player%(gamen
o%)) OF
 900 WHEN 0:PROCdonecomputermove(gameno
%,player%(gameno%))
 910 WHEN 1:PROCdoneplayermove(gameno%,
player%(gameno%))
 920 ENDCASE
 930 :
 940 moves%(gameno%,player%(gameno%))+=
1
 950 PROCrestoreboard(gameno%)
 960 status%(gameno%)=stat_premove%
 970 ENDIF
 980 WHEN stat_premove%:
 990 z%=FNfunc(gameno%,"unlistmoves")
1000 z%=FNfunc(gameno%,"initdomove")
1010 status%(gameno%)=stat_move%
1020 WHEN stat_move%:
1030 z%=FNfunc(gameno%,"domove")
1040 PROCpreserveboard(gameno%)
1050 IF z% THEN status%(gameno%)=stat_p
ostmove%
1060 WHEN stat_postmove%
1070 player%(gameno%)=1-player%(gameno%
)
1080 IF player%(gameno%)=starts%(gameno
%) turn%(gameno%)+=1
1090 status%(gameno%)=stat_prethink%
1100 ENDCASE
1110 info%(gameno%)?61=stale%(gameno%)
1120 winner%(gameno%)=FNfunc(gameno%,"g
ameover")
1130 UNTIL winner%(gameno%)<>-2
1140 IF winner%(gameno%)=-1 THEN
1150 games(gameno%,0)+=.5
1160 games(gameno%,1)+=0.5
1170 ELSE
1180 games(gameno%,winner%(gameno%))+=1
1190 ENDIF
1200 :
1210 starts%(gameno%)=1-starts%(gameno%
)
1220 game%+=1
1230 PROCc("  Game Over  ",6)
1240 FOR p%=0 TO 1
1250 PROCc("Player "+STR$(p%+1)+", Game
s="+STR$(games(gameno%,p%)),24+p%)
1260 NEXT
1270 PROCc("Click mouse to continue..."
,12)
1280 REPEAT:MOUSE x,y,b:UNTIL b=0
1290 REPEAT:MOUSE x,y,b:UNTIL b<>0
1300 UNTIL FALSE
1310 END
1320 :
1330 DEF PROCc(t$,y%)
1340 PRINTTAB(60-LEN(t$)/2,y%)t$
1350 ENDPROC
1360 :
1370 DEF PROCmaininit
1380 MOUSE x%,y%,wasbut%
1390 think$=">          "
1400 maxgames%=8
1410 DIM pres% &300
1420 DIM scale% 16
1430 scale%!0=256*0.5
1440 scale%!4=256*0.5
1450 scale%!8=256
1460 scale%!12=256
1470 DIM games(maxgames%,1),examined(ma
xgames%,1),step(maxgames%,1)
1480 DIM last(maxgames%,1),timeforlast(
maxgames%,1)
1490 DIM timepermove(maxgames%,1),contr
ol(maxgames%,1)
1500 DIM info%(maxgames%),s%(maxgames%)
,f$(maxgames%)
1510 DIM player%(maxgames%),starts%(max
games%)
1520 DIM moves%(maxgames%,1)
1530 DIM prethink%(maxgames%)
1540 DIM gameover%(maxgames%),winner%(m
axgames%)
1550 DIM couldmove%(maxgames%)
1560 DIM best%(maxgames%),turn%(maxgame
s%)
1570 DIM status%(maxgames%)
1580 DIM stale%(maxgames%)
1590 DIM spare%(maxgames%)
1600 stat_prethink%=0
1610 stat_think%=1
1620 stat_premove%=2
1630 stat_move%=3
1640 stat_postmove%=4
1650 slice%=5
1660 :
1670 llflg  =1<<0
1680 frcflg =1<<1
1690 hltflg =1<<2
1700 winflg =1<<3
1710 rndflg =1<<4
1720 laflg  =1<<5
1730 inlaflg=1<<6
1740 nullflg=1<<7
1750 :
1760 who=0
1770 level=1
1780 bestptr=2
1790 val=3
1800 delta=4
1810 base2=5
1820 temp=6
1830 temp2=7
1840 beta=8:nval=8
1850 maxsofar=9:minsofar=9:temp3=9
1860 base=10
1870 alpha=11:temp4=11
1880 wkpt=12:brd=12
1890 sp=13
1900 link=14
1910 pc=15
1920 :
1930 vbit=1<<28
1940 cbit=1<<29
1950 ENDPROC
1960 :
1970 DEF PROCinitcomputermove(gameno%,w
ho%)
1980 gotvalidmove%=FALSE
1990 flgs%=0
2000 IF turn%(gameno%)<5 flgs%=flgs% OR
 rndflg
2010 level%=info%(gameno%)?52
2020 level2%=info%(gameno%)?53
2030 finished%=0
2040 prethink%(gameno%)=TRUE
2050 cutofftime%=TIME+timepermove(gamen
o%,who%)*1.1
2060 couldmove%(gameno%)=TRUE
2070 ENDPROC
2080 :
2090 DEF PROCinitplayermove(gameno%,who
%)
2100 z%=FNfunc(gameno%,"initgetmove")
2110 ENDPROC
2120 :
2130 DEF PROCdonecomputermove(gameno%,w
ho%)
2140 IF finished%<2 THEN
2150 last(gameno%,0)=info%(gameno%)?52
2160 last(gameno%,1)=info%(gameno%)?52
2170 ENDIF
2180 ENDPROC
2190 :
2200 DEF PROCdoneplayermove(gameno%,who
%)
2210 ENDPROC
2220 :
2230 DEF FNgetcomputermove(gameno%,who%
)
2240 LOCAL gotmove%
2250 gotmove%=FALSE
2260 IF gotvalidmove% AND TIME>cutoffti
me% THEN
2270 gotmove%=TRUE
2280 ELSE
2290 IF prethink%(gameno%) THEN
2300 prethink%(gameno%)=FALSE
2310 timestarted=TIME
```

►

```
2320 SYS "GameCore_Think",who%,1,inst1%,level%,level2%,flgs% TO ex%,status%,numposs%,result%
2330 ELSE
2340 SYS "GameCore_Continue",,slice%,inst1% TO ex%,status%,numposs%,result%
2350 ENDIF
2360 examined(gameno%,who%)+=ex%
2370 IF status%=0 THEN
2380 finished%+=1
2390 prethink%(gameno%)=TRUE
2400 IF numposs%>0 THEN
2410 IF numposs%=1 THEN
2420 i%=0
2430 ELSE
2440 REPEAT
2450 i%=RND(numposs%)-1
2460 UNTIL !(!(result%+4*i%))=!!result%
2470 ENDIF
2480 PROCcopy(best%(gameno%),!(result%+4*i%),info%(gameno%)?55)
2490 IF !best%(gameno%)>&FE00 gotmove%=TRUE
2500 ELSE
2510 couldmove%(gameno%)=FALSE
2520 gotmove%=TRUE
2530 ENDIF
2540 IF NOT gotvalidmove% THEN
2550 level%=last(gameno%,who%)
2560 IF timeforlast(gameno%,who%)>0.9*(cutofftime%-TIME) AND level%>2 level%-=step(gameno%,who%)
2570 ELSE
2580 last(gameno%,who%)=level%
2590 timeforlast(gameno%,who%)=TIME-timestarted
2600 level%+=step(gameno%,who%)
2610 IF timeforlast(gameno%,who%)>(cutofftime%-TIME)/2 gotmove%=TRUE
2620 ENDIF
2630 level2%=level%+info%(gameno%)?54
2640 gotvalidmove%=TRUE
2650 IF level2%>=info%(gameno%)?24 THEN gotmove%=TRUE
2660 ENDIF
2670 ENDIF
2680 =gotmove%
2690 :
2700 DEF FNpassonclicks(gameno%,who%,f$)
2710 LOCAL gotmove%
2720 gotmove%=FALSE
2730 MOUSE x%,y%,but%
2740 IF but%<>wasbut% THEN
2750 IF but%<>0 THEN
2760 IF x%>=0 AND x%<info%(gameno%)!32 THEN
2770 IF y%>=0 AND y%<info%(gameno%)!36 THEN
2780 info%(gameno%)!64=x%
2790 info%(gameno%)!68=y%
2800 info%(gameno%)!72=but%
2810 gotmove%=FNfunc(gameno%,f$)
2820 ENDIF
2830 ENDIF
2840 ENDIF
2850 wasbut%=but%
2860 ENDIF
2870 =gotmove%
2880 :
2890 DEF PROCcopy(to%,from%,n%)
2900 LOCAL i%
2910 IF n%>0 THEN
2920 IF to%>from% THEN
2930 FOR i%=n%-1 TO 0 STEP -1:i%?to%=i%?from%:NEXT
2940 ELSE
2950 FOR i%=0 TO n%-1:i%?to%=i%?from%:NEXT
2960 ENDIF
2970 ENDIF
2980 ENDPROC
2990 :
3000 DEF PROCpreserveboard(gameno%)
3010 PROCcopy(spare%(gameno%),!info%(gameno%),info%(gameno%)!40)
3020 ENDPROC
3030 :
3040 DEF PROCrestoreboard(gameno%)
3050 PROCcopy(!info%(gameno%),spare%(gameno%),info%(gameno%)!40)
3060 ENDPROC
3070 :
3080 DEF FNfunc(gameno%,fn$)
3090 LOCAL r0%,r1%,r2%,r3%,z%,w%,x0%,y0%,x1%,y1%
3100 IF s%(gameno%)>0 THEN
3110 !pres%=0
3120 SYS "OS_SpriteOp",60+256,s%(gameno%),"board",pres% TO r0%,r1%,r2%,r3%
3130 VDU 5
3140 SYS "OS_ChangedBox",2
3150 SYS "OS_ChangedBox",1
3160 ENDIF
3170 z%=EVAL("FN"+f$(gameno%)+"_"+fn$+"("+STR$(info%(gameno%))+")")
3180 IF s%(gameno%)>0 THEN
3190 SYS "OS_ChangedBox",-1 TO ,w%
3200 x0=2*w%!4
3210 y0=4*w%!8
3220 x1=2*w%!12
3230 y1=4*w%!16
3240 SYS "OS_SpriteOp",r0%,r1%,r2%,r3%
3250 IF x0<x1 AND y0<y1 THEN
3260 VDU 24,x0;y0;x1;y1;
3270 SYS "OS_SpriteOp",34+256,s%(gameno%),"board",0,0,0
3280 VDU 26,28,40,31,120,0
3290 ENDIF
3300 ENDIF
3310 =z%
3320 :
3330 DEF FNgetablock(please%)
3340 DIM lights% please%
3350 =lights%
```

Listing 2

```
10 REM >GCS1 (GameCore2)
20 REM GameCore module source
30 REM by Adam Broges
40 REM for Archimedes only
50 REM (c) BAU July 1991
60 :
70 DIM code% &1000
80 PROCass
90 PRINT"Bytes used: ";O%-code%
100 SYS "OS_File",10,"GameCore",&FFA,,code%,O%
110 END
120 :
130 DEF PROCass
140 maxinst%=8
150 instreq%=64
160 ptroff%=instreq%
170 ptrsize%=32*1024-ptroff%
180 required%=ptroff%+ptrsize%
190 :
200 tickerv=&1C
210 :
220 llflg  =1<<0
230 frcflg =1<<1
240 hltflg =1<<2
250 winflg =1<<3
260 rndflg =1<<4
270 laflg  =1<<5
280 inlaflg=1<<6
290 nullflg=1<<7
300 imflg  =1<<10
310 :
320 qpti=3
330 qptj=4
340 qsa=5
350 qsn=6
360 qsi=7
370 qsj=8
380 qsp=9
390 qstemp=10
400 qstemp2=11
410 :
420 who=0
430 level=1
440 bestptr=2
450 val=3
460 ptr=4
470 base2=5
480 temp=6
490 temp2=7
500 beta=8:nval=8
510 maxsofar=9:minsofar=9:temp3=9
520 base=10
530 alpha=11:temp4=11
540 wkpt=12:brd=12
550 sp=13
560 link=14
570 pc=15
580 :
590 vbit=1<<28
600 cbit=1<<29
610 :
620 FOR pass%=4 TO 6 STEP 2
630 P%=0:O%=code%
640 [OPT pass%
650 .modstart
660 EQUD 0
670 EQUD init
680 EQUD quit
690 EQUD 0
700 EQUD title
710 EQUD help
720 EQUD 0
730 EQUD &CD7C0
740 EQUD swihandler
750 EQUD switable
760 EQUD 0
770 :
780 .title
790 FNequz("GameCore")
800 .help
810 FNequz("GameCore"+CHR$(9)+"0.20 ("+MID$(TIME$,5,11)+")")
820 :
830 .init
840 STMFD (sp)!,{link}
850 MOV R0,#tickerv
860 ADR R1,tickroutine
870 MOV R2,#0
880 SWI "XOS_Claim"
890 LDMFD (sp)!,{pc}
900 :
910 .quit
920 STMFD (sp)!,{R0-R12,link}
930 ADR R8,instptr
940 MOV R9,#0
950 MOV R0,#7
960 .quitloop
970 LDR R2,[R8,R9,ASL #2]
980 CMP R2,#0
990 SWINE "XOS_Module"
1000 ADD R9,R9,#1
1010 CMP R9,#maxinst%
1020 BLT quitloop
1030 MOV R0,#tickerv
1040 ADR R1,tickroutine
1050 MOV R2,#0
1060 SWI "XOS_Release"
1070 LDMFD (sp)!,{R0-R12,pc}
1080 :
1090 .tickroutine
1100 STMFD (sp)!,{R0,link}
1110 LDR R0,ticker
1120 ADD R0,R0,#1
1130 STR R0,ticker
1140 LDMFD (sp)!,{R0,pc}^
1150 :
1160 .ticker
1170 EQUD 0
1180 :
1190 .swihandler
1200 CMP R11,#6
1210 ADDCC pc,pc,R11,LSL #2
1220 B returntosender
1230 .jumptable
1240 B gcinit
1250 B think
1260 B validate
1270 B kill
1280 B continue
1290 B stale
1300 :
1310 .returntosender
1320 ADR R0,errmsg
1330 ORRS pc,R14,#vbit
1340 .errmsg
1350 EQUD &801A00+1
1360 EQUS "Unrecognised GameCore SWI"
1370 EQUB 0
1380 ALIGN
1390 :
1400 .switable
1410 EQUS "GameCore"
1420 EQUB 0
1430 EQUS "Init"
1440 EQUB 0
1450 EQUS "Think"
1460 EQUB 0
1470 EQUS "Validate"
1480 EQUB 0
1490 EQUS "Kill"
1500 EQUB 0
1510 EQUS "Continue"
1520 EQUB 0
1530 EQUS "Stale"
1540 EQUB 0
1550 ALIGN
1560 :
1570 .validate
1580 STMFD (sp)!,{R1-R12,link}
1590 STR R3,movelength
1600 BL getinst
1610 MOV ptr,R1
1620 MOV level,#0
1630 ADD bestptr,wkpt,#ptroff%
1640 LDR wkpt,[wkpt]
1650 MOV link,pc
1660 LDR pc,initlistmovesaddr
1670 :
1680 .validateloop
1690 STMFD (sp)!,{bestptr,level}
1700 BIC level,level,#hltflg+frcflg
1710 MOV link,pc
1720 LDR pc,listonemoveaddr
1730 LDMFD (sp)!,{bestptr,level}
1740 MOV link,pc
1750 BVS nomovetocheck
1760 STMFD (sp)!,{R3,R5,R6,R7,bestptr}
1770 ADD bestptr,bestptr,#12
1780 LDR R7,movelength
1790 MOV R3,#0
1800 :
1810 .checkmove
1820 LDRB R5,[bestptr,R3]
1830 LDRB R6,[ptr,R3]
1840 CMP R5,R6
1850 LDMNEFD (sp)!,{R3,R5,R6,R7,bestptr}
1860 BNE nomovetocheck
1870 ADD R3,R3,#1
1880 CMP R3,R7
1890 BLT checkmove
1900 LDMFD (sp)!,{R3,R5,R6,R7,bestptr}
1910 MVN R0,#0
1920 LDMFD (sp)!,{R1-R12,link}
1930 BICS pc,link,#vbit
1940 :
1950 .nomovetocheck
1960 TST link,#cbit
1970 BEQ validateloop
1980 MOV R0,#0
1990 LDMFD (sp)!,{R1-R12,link}
2000 BICS pc,link,#vbit
2010 :
2020 .stale
2030 STMFD (sp)!,{R1-R12,link}
2040 BL getinst
2050 MOV level,#0
2060 ADD bestptr,wkpt,#ptroff%
2070 LDR wkpt,[wkpt]
2080 MOV link,pc
2090 LDR pc,initlistmovesaddr
2100 :
2110 .checkstaleloop
2120 STMFD (sp)!,{bestptr,level}
2130 BIC level,level,#hltflg+frcflg
2140 MOV link,pc
2150 LDR pc,listonemoveaddr
2160 LDMFD (sp)!,{bestptr,level}
2170 MOV link,pc
2180 BVC notstale
2190 BCC checkstaleloop
2200 MVN R0,#0
2210 LDMFD (sp)!,{R1-R12,link}
2220 BICS pc,link,#vbit
2230 :
2240 .notstale
2250 MOV R0,#0
2260 LDMFD (sp)!,{R1-R12,link}
2270 BICS pc,link,#vbit
2280 :
2290 .movelength
2300 EQUD 0
2310 :
2320 .gcinit
2330 STMFD (sp)!,{R1-R12,link}
2340 MOV R11,R0
2350 ADR R9,instptr
2360 MOV R8,#0
2370 :
2380 .findinst
2390 LDR R10,[R9,R8,ASL #2]
2400 CMP R10,#0
2410 BEQ foundinst
2420 ADD R8,R8,#1
2430 CMP R8,#maxinst%
2440 BLT findinst
2450 :
2460 .cantinit
2470 ADR R0,toomany
2480 LDMFD (sp)!,{R1-R12,link}
2490 ORRS pc,link,#vbit
2500 :
2510 .foundinst
2520 MOV R0,#6
2530 MOV R3,#required%
2540 SWI "XOS_Module"
2550 BVS cantinit
2560 STR R2,[R9,R8,ASL #2]
2570 LDMIA (11)!,{R4-R7}
2580 STMIA (2)!,{R4-R7}
2590 LDMIA (11)!,{R4-R7}
2600 STMIA (2)!,{R4-R7}
2610 LDMIA (11)!,{R4-R7}
2620 STMIA (2)!,{R4-R7}
2630 LDMIA (11)!,{R4-R7}
2640 STMIA (2)!,{R4-R7}
2650 MOV R0,R8
2660 LDMFD (sp)!,{R1-R12,link}
2670 BICS pc,link,#vbit
2680 :
2690 .kill
2700 STMFD (sp)!,{R0-R12,link}
2710 CMP R0,#0
2720 BLT cantkill
2730 CMP R0,#maxinst%
2740 BGE cantkill
2750 ADR R1,instptr
2760 LDR R2,[R1,R0,ASL #2]
2770 MOV R3,#0
2780 STR R3,[R1,R0,ASL #2]
2790 CMP R2,#0
2800 BEQ cantkill
2810 MOV R0,#7
2820 SWI "XOS_Module"
2830 LDMVCFD (sp)!,{R0-R12,link}
2840 BICVCS pc,link,#vbit
2850 :
2860 .cantkill
2870 LDMFD (sp)!,{R0-R12,link}
2880 ADR R0,nosuch
2890 ORRS pc,link,#vbit
2900 :
2910 .toomany
2920 EQUD 0
2930 FNequz("Too many GameCore instantiations")
2940 :
2950 .nosuch
2960 EQUD 0
2970 FNequz("Unknown GameCore instantiation")
2980 :
2990 .workaddr          :EQUD 0
3000 .moveaddr          :EQUD 0
3010 .unmoveaddr        :EQUD 0
3020 .initlistmovesaddr :EQUD 0
3030 .listonemoveaddr   :EQUD 0
3040 .lookaheaddepth1   :EQUB 0
3050 .lookaheaddepth2   :EQUB 0
3060 .lookaheadmask     :EQUB 0
3070                    :EQUB 0
3080 .absmax            :EQUB 0
3090 .staletype         :EQUB 0
3100                    :EQUW 0
3110 .staleaddr         :EQUD 0
3120 :
3130 .curinst           :EQUD 0
3140 .timeout           :EQUD 0
3150 .reg               :EQUS STRING$(16,CHR$0)
3160 .total             :EQUD 0
3170 .levelstore        :EQUD 0
3180 :
3190 .mainthink
3200 STR R13,reg+8
3210 STR R14,reg+12
```

```
3220 TST R3,#%1
3230 ADDNE R3,R3,#1
3240 STR R3,maxdepth
3250 STR R4,maxdepth2
3260 MOV level,R5,ASL #16
3270 MOV level,level,LSR #16
3280 MOV temp,#0
3290 STR temp,total
3300 MOV val,#0
3310 MVN alpha,#&10000
3320 MOV beta,#&10000
3330 ADD ptr,wkpt,#ptroff%
3340 LDR sp,[wkpt,#44]
3350 LDR wkpt,[wkpt]
3360 BL try
3370 BL sort
3380 LDR R13,reg+8
3390 LDR R14,reg+12
3400 MOV pc,link
3410 :
3420 .maxdepth  :EQUD 0
3430 .maxdepth2 :EQUD 0
3440 :
3450 .instptr
3460 EQUS STRING$(4*maxinst%,CHR$0)
3470 :
3480 .try
3490 STMFD (sp)!,{maxsofar,bestptr,ptr,
alpha,beta,level,link}
3500 :
3510 .carryon
3520 TST level,#1<<16
3530 MVNEQ maxsofar,#&10000
3540 MOVNE minsofar,#&10000
3550 LDR temp2,maxdepth
3560 CMP temp2,level,LSR #16
3570 ORRLE level,level,#llflg
3580 BICGT level,level,#llflg
3590 LDR temp2,ticker
3600 CMP temp2,#2
3610 BLT skiptimeout
3620 MOV temp2,#0
3630 STR temp2,ticker
3640 STMFD (sp)!,{R0,R1}
3650 SWI "XOS_ReadEscapeState"
3660 BCS dotimeout
3670 SWI "XOS_ReadMonotonicTime"
3680 LDR R1,timeout
3690 CMP R0,R1
3700 BLT notimeout
3710 :
3720 .dotimeout
3730 LDMFD (sp)!,{R0,R1}
3740 STMFD (sp)!,{R0-R12,R14}
3750 ADR R1,timeoutstack
3760 LDR R2,curinst
3770 STR sp,[R1,R2,ASL #2]
3780 LDR R13,reg
3790 LDMFD (sp)!,{R1-R12,R14}
3800 LDR R0,total
3810 MOV R1,#1
3820 MOV R2,#0
3830 MOV pc,link
3840 :
3850 .notimeout
3860 LDMFD (sp)!,{R0,R1}
3870 :
3880 .skiptimeout
3890 TST level,#llflg
3900 BNE nolookahead
3910 LDRB temp2,lookaheadmask
3920 TST level,temp2
3930 TSTEQ level,#inlaflg
3940 BNE nolookahead
3950 TST level,#laflg
3960 BEQ nolookahead
3970 MOV temp2,level,LSR #16
3980 LDRB base,lookaheaddepth1
3990 ADD temp2,temp2,base
4000 LDR base,maxdepth
4010 CMP temp2,base
4020 BGE nolookahead
4030 LDR temp,maxdepth
4040 LDR temp2,maxdepth2
4050 STMFD (sp)!,{temp,temp2,val}
4060 MOV temp2,level,LSR #16
4070 LDRB base,lookaheaddepth1
4080 ADD temp2,temp2,base
4090 STR temp2,maxdepth
4100 LDRB base,lookaheaddepth2
4110 ADD temp2,temp2,base
4120 STR temp2,maxdepth2
4130 ORR level,level,#inlaflg
4140 BL try
4150 MOV bestptr,temp2
4160 BIC level,level,#inlaflg
4170 LDMFD (sp)!,{temp,temp2,val}
4180 STR temp,maxdepth
4190 STR temp2,maxdepth2
4200 BL sort
4210 ADR base,listend%
4220 LDR ptr,[base,level,LSR #14]
4230 ADR base,liststart%
4240 LDR temp,[base,level,LSR #14]
4250 :
4260 .restorevals
4270 LDR base,[temp],#4
4280 LDR temp2,[base,#4]
4290 STR temp2,[base]
4300 CMP temp,ptr
4310 BLT restorevals
4320 ADR base,liststart%
4330 LDR temp,[base,level,LSR #14]
4340 B donela
4350 :
4360 .nolookahead
4370 ADR base,liststart%
4380 STR ptr,[base,level,LSR #14]
4390 STMFD (sp)!,{R3,R5-R11}
4400 MOV link,pc
4410 LDR pc,initlistmovesaddr
4420 STR level,levelstore
4430 :
4440 .loop
4450 STR bestptr,[ptr]
4460 BIC level,level,#hltflg+frcflg+nul
lflg
4470 :
4480 .blonemove
4490 EQUD 0
4500 LDR level,levelstore
4510 ADDVC ptr,ptr,#4
4520 BCC loop
4530 LDMFD (sp)!,{R3,R5-R11}
4540 ADR base,liststart%
4550 LDR temp,[base,level,LSR #14]
4560 CMP temp,ptr
4570 BNE notnone
4580 TST level,#&FF0000
4590 BEQ notnone
4600 STMFD (sp)!,{val}
4610 .blstale
4620 MOV val,#0
4630 EQUD 0
4640 LDRB base,staletype
4650 TST base,#%1
4660 BEQ smallowed
4670 :
4680 .smforbidden
4690 LDMFD (sp)!,{temp2}
4700 TST level,#1<<16
4710 ADDEQ maxsofar,temp2,val
4720 SUBNE maxsofar,temp2,val
4730 B mademoves
4740 :
4750 .smallowed
4760 STR bestptr,[ptr],#4
4770 MOV temp2,#0
4780 ORR base,level,#nullflg
4790 STR val,[bestptr],#4
4800 STR val,[bestptr],#4
4810 STR base,[bestptr],#4
4820 STR temp2,[bestptr],#4
4830 LDMFD (sp)!,{val}
4840 :
4850 .notnone
4860 ADR base,listend%
4870 STR ptr,[base,level,LSR #14]
4880 BL sort
4890 :
4900 .donela
4910 .makemoves
4920 CMP temp,ptr
4930 BEQ mademoves
4940 STMFD (sp)!,{val,temp,level}
4950 LDR temp,[temp]
4960 LDR temp2,[temp,#4]
4970 LDR level,[temp,#8]
4980 TST level,#winflg
4990 MOVNE val,#0
5000 TST level,#1<<16
5010 ADDEQ val,val,temp2
5020 SUBNE val,val,temp2
5030 TST level,#hltflg
5040 BNE halthere
5050 TST level,#frcflg
5060 BNE forced
5070 TST level,#llflg
5080 BEQ further
5090 :
5100 .halthere
5110 LDR temp2,total
5120 ADD temp2,temp2,#1
5130 STR temp2,total
5140 B nofurther
5150 :
5160 .forced
5170 LDR temp2,maxdepth2
5180 CMP temp2,level,LSR #16
5190 BLE halthere
5200 :
5210 .further
5220 STMFD (sp)!,{temp,level}
5230 TST level,#nullflg
5240 BNE skipblmove
5250 :
5260 .blmove
5270 EQUD 0
5280 :
5290 .skipblmove
5300 ADD level,level,#1<<16
5310 RSB who,who,#1
5320 BL try
5330 RSB who,who,#1
5340 LDMFD (sp)!,{temp,level}
5350 TST level,#nullflg
5360 BNE skipblunmove
5370 :
5380 .blunmove
5390 EQUD 0
5400 :
5410 .skipblunmove
5420 .nofurther
5430 MOV temp2,val
5440 LDMFD (sp)!,{val,temp,level}
5450 LDR base2,[temp],#4
5460 TST level,#1<<16
5470 BNE oddlevel
5480 CMP temp2,maxsofar
5490 MOVGT maxsofar,temp2
5500 TSTEQ level,#rndflg
5510 SUBEQ temp2,temp2,#1
5520 CMP maxsofar,alpha
5530 MOVGT alpha,maxsofar
5540 STR temp2,[base2]
5550 CMP maxsofar,beta
5560 BLT makemoves
5570 BNE mademoves
5580 TST level,#rndflg
5590 BNE makemoves
5600 B mademoves
5610 :
5620 .oddlevel
5630 CMP temp2,minsofar
5640 MOVLT minsofar,temp2
5650 ADDEQ temp2,temp2,#1
5660 CMP minsofar,beta
5670 MOVLT beta,minsofar
5680 STR temp2,[base2]
5690 CMP minsofar,alpha
5700 BGT makemoves
5710 BNE mademoves
5720 TST level,#rndflg
5730 BNE makemoves
5740 :
5750 .mademoves
5760 TST level,#inlaflg
5770 ADREQ base,listend%
5780 STREQ temp,[base,level,LSR #14]
5790 MOV val,maxsofar
5800 MOV temp2,bestptr
5810 LDMFD (sp)!,{bestptr,ptr,maxsofar,
alpha,beta,level,pc}
5820 :
5830 .timeoutstack
5840 EQUS STRING$(4*maxinst%,CHR$0)
5850 :
5860 .getinst
5870 STMFD (sp)!,{R1,R3-R11,link}
5880 ADR R1,instptr
5890 LDR wkpt,[R1,R2,ASL #2]
5900 ADR R9,workaddr
5910 LDMIA (wkpt),{R1-R8}
5920 STMIA (9),{R1-R8}
5930 LDR temp,moveaddr
5940 ADR temp2,blmove
5950 BL assbl
5960 LDR temp,unmoveaddr
5970 ADR temp2,blunmove
5980 BL assbl
5990 LDR temp,listonemoveaddr
6000 ADR temp2,blonemove
6010 BL assbl
6020 LDR temp,staleaddr
6030 ADR temp2,blstale
6040 BL assbl
6050 LDR bestptr,[wkpt,#48]
6060 LDMFD (sp)!,{R1,R3-R11,pc}
6070 :
6080 .sort
6090 STMFD (sp)!,{R1-R11,link}
6100 ADR qsa,liststart%
6110 LDR qsa,[qsa,level,LSR #14]
6120 ADR qstemp2,listend%
6130 LDR qstemp2,[qstemp2,level,LSR #14
]
6140 SUB qsn,qstemp2,qsa
6150 MOV qsn,qsn,LSR #2
6160 BL qsort2
6170 LDMFD (sp)!,{R1-R11,pc}
6180 :
6190 .qsort2
6200 CMP qsn,#1
6210 MOVLE pc,link
6220 STMFD (sp)!,{link}
6230 LDR qstemp,[qsa]
6240 LDR qstemp,[qstemp]
6250 MOV qsi,#1
6260 :
6270 .findpivot2
6280 LDR qpti,[qsa,qsi,ASL #2]
6290 LDR qstemp2,[qpti]
6300 CMP qstemp,qstemp2
6310 BNE gotpiv2
6320 ADD qsi,qsi,#1
6330 CMP qsi,qsn
6340 BNE findpivot2
6350 LDMFD (sp)!,{pc}
6360 :
6370 .gotpiv2
6380 MOVLT qsp,qstemp
6390 MOVGT qsp,qstemp2
6400 MOV qsi,#0
6410 SUB qsj,qsn,#1
6420 :
6430 .noswap
6440 CMP qsi,qsj
6450 BGT parted2
6460 .partloop2a
6470 LDR qpti,[qsa,qsi,ASL #2]
6480 LDR qstemp,[qpti]
6490 CMP qstemp,qsp
6500 ADDGT qsi,qsi,#1
6510 BGT partloop2a
6520 :
6530 .partloop2b
6540 LDR qptj,[qsa,qsj,ASL #2]
6550 LDR qstemp2,[qptj]
6560 CMP qstemp2,qsp
6570 SUBLE qsj,qsj,#1
6580 BLE partloop2b
6590 CMP qsi,qsj
6600 BGE noswap
6610 STR qpti,[qsa,qsj,ASL #2]
6620 STR qptj,[qsa,qsi,ASL #2]
6630 ADD qsi,qsi,#1
6640 SUB qsj,qsj,#1
6650 CMP qsi,qsj
6660 BLE partloop2a
6670 :
6680 .parted2
6690 STMFD (sp)!,{qsa,qsi,qsn}
6700 MOV qsn,qsi
6710 BL qsort2
6720 LDMFD (sp)!,{qsa,qsi,qsn}
6730 ADD qsa,qsa,qsi,ASL #2
6740 SUB qsn,qsn,qsi
6750 BL qsort2
6760 LDMFD (sp)!,{qsa,qsi,qsn,pc}
6770 :
6780 .assbl
6790 CMP temp,#0
6800 LDREQ temp,dummyinst
6810 SUBNE temp,temp,temp2
6820 SUBNE temp,temp,#8
6830 MOVNE temp,temp,ASR #2
6840 BICNE temp,temp,#(%11111111)<<24
6850 ORRNE temp,temp,#(%11101011)<<24
6860 STR temp,[temp2]
6870 MOV pc,link
6880 :
6890 .dummyinst
6900 MOVNV R0,R0
6910 :
6920 .continue
6930 STMFD (sp)!,{R1-R12,R14}
6940 STR R2,curinst
6950 STR R13,reg
6960 STMFD (sp)!,{R0,R2}
6970 SWI "OS_ReadMonotonicTime"
6980 ADD R1,R1,R0
6990 STR R1,timeout
7000 LDMFD (sp)!,{R0,R2}
7010 MOV temp,#0
7020 STR temp,total
7030 ADR temp,timeoutstack
7040 LDR sp,[temp,R2,ASL #2]
7050 LDMFD (sp)!,{R0-R12,R14}
7060 B carryon
7070 :
7080 .think
7090 STMFD (sp)!,{R1-R12,R14}
7100 STR R2,curinst
7110 STR R13,reg
7120 STMFD (sp)!,{R0}
7130 SWI "OS_ReadMonotonicTime"
7140 ADD R1,R1,R0
7150 STR R1,timeout
7160 LDMFD (sp)!,{R0}
7170 BL getinst
7180 BL mainthink
7190 MOV R0,ptr
7200 LDR R13,reg
7210 LDMFD (sp)!,{R1-R12,R14}
7220 MOV R3,R0
7230 LDR R0,total
7240 MOV R1,#0
7250 LDR R2,liststart%
7260 LDR R4,listend%
7270 SUB R2,R4,R2
7280 MOV R2,R2,LSR #2
7290 MOV pc,link
7300 ]
7310 liststart%=P%
7320 O%+=256:P%+=256
7330 listend%=liststart%+4
7340 NEXT pass%
7350 ENDPROC
7360 :
7370 DEF FNequz(z$)
7380 [OPT pass%
7390 EQUS z$
7400 EQUB 0
7410 ALIGN
7420 ]
7430 =0
```

Listing 3

```
10 REM >TD (GameCore3)
20 REM 3D N & C library
30 REM by Adam Broges
40 REM for Archimedes only
50 REM (c) BAU July 1991
60 :
70 DEF FNtd_desc="3D Noughts & Crosse
s"
80 :
90 DEF FNtd_idle(info%)
100 IF info%!72=0 OR info%!68>32 THEN
=0
110 LOCAL x%,y%,b%,z%
120 x%=info%!64
130 y%=info%!68
140 b%=info%!72
150 CASE TRUE OF
160 WHEN x%<=16:PROCtd_rotate(info%,-1
6)
170 WHEN x%>=512-15:PROCtd_rotate(info
%,16)
180 WHEN x%>=256-40 AND x%<=256+40:
190 info%?92=(info%?92) EOR 1
200 PROCtd_buildtab(info%)
210 z%=FNtd_showboard(info%)
220 ENDCASE
```

```
230 =Ø
240 :
250 DEF PROCtd_rotate(info%,angle%)
260 info%?93+=angle%
270 |(info%+94)=SIN(info%?93*PI/128)
280 |(info%+99)=COS(info%?93*PI/128)
290 PROCtd_buildtab(info%)
300 z%=FNtd_showboard(info%)
310 ENDPROC
320 :
330 DEF FNtd_getmove(info%)
340 LOCAL best%,b%,x%,y%,l%,gotmove%,z
%,board%,usep%
350 gotmove%=FALSE
360 best%=info%!56
370 x%=info%!64
380 y%=info%!68
390 b%=info%!72
400 IF y%<=32 THEN z%=FNtd_idle(info%)
:=FALSE
410 IF POINT(x%,y%)<4 THEN
420 i%=16*POINT(x%,y%)-1
430 board%=!info%
440 usep%=info%?92=1
450 SYS "Hourglass_On"
460 WHILE NOT gotmove%
470 i%+=1
480 IF board%?i%=&FF THEN
490 PROCtd_indic(board%,i%,5,i%/16,use
p%)
500 IF POINT(x%,y%)=5 gotmove%=TRUE
510 PROCtd_indic(board%,i%,i%/16,5,use
p%)
520 ENDIF
530 ENDWHILE
540 SYS "Hourglass_Off"
550 best%?12=i%
560 ENDIF
570 =gotmove%
580 :
590 DEF FNtd_initdomove(info%)
600 info%!80=TIME
610 info%!84=Ø:REM counter
620 info%!88=?(info%!56+12)
630 =Ø
640 :
650 DEF FNtd_domove(info%)
660 LOCAL doneanim%
670 doneanim%=FALSE
680 IF TIME-info%!80>10 THEN
690 info%!80=TIME
700 info%!84+=1
710 IF info%!84=7 THEN
720 doneanim%=TRUE
730 ?(!info%+info%!88)=info%?60
740 PROCtd_showsquare(!info%,info%!88,
-1,info%?92=1)
750 ELSE
760 PROCtd_showsquare(!info%,info%!88,
6*(info%!84 MOD 2),info%?92=1)
770 ENDIF
780 ENDIF
790 =doneanim%
800 :
810 DEF FNtd_newgame(info%)
820 LOCAL i%
830 FOR i%=Ø TO 63 STEP 4
840 !(!info%+i%)=-1
850 NEXT
860 =Ø
870 :
880 DEF FNtd_showboard(info%)
890 LOCAL i%,b%,p%
900 b%=!info%+info%!40
910 p%=info%?92=1
920 GCOL 132
930 CLG
940 FOR i%=Ø TO 63
950 PROCtd_showsquare(b%,i%,-1,p%)
960 NEXT
970 GCOL 7
980 MOVE Ø,32
990 VDU 136
1000 MOVE 512-16,32
1010 VDU 137
1020 MOVE 256-40,32
1030 PRINT"2D-3D";
1040 =Ø
1050 :
1060 DEF PROCtd_indic(board%,i%,col1%,c
ol2%,usep%)
1070 LOCAL level%,row%,column%,xØ%,x1%,
yØ%,y1%
1080 level%=i%>>4
1090 row%=(i%>>2) AND 3
1100 column%=i% AND 3
1110 GCOL 128+col2%
1120 GCOL col1%
1130 IF usep% THEN
1140 PROCtd_getxy(level%,row%,column%,x
Ø%,yØ%)
1150 PROCtd_getxy(level%,row%+1,column%
+1,x1%,y1%)
1160 FILL (xØ%+x1%)/2,(yØ%+y1%)/2
1170 ELSE
1180 FILL td_lm%+td_sq%*(column%+Ø.5),1
28+td_sq%*(row%+4*level%+Ø.5)+16*level%+
16
1190 ENDIF
1200 ENDPROC
1210 :
1220 DEF PROCgcol(col%,b%,i%)
1230 IF col%<Ø THEN
1240 IF b%?i%=&FF GCOL i%/16 ELSE GCOL
7+b%?i%
1250 ELSE
1260 GCOL col%
1270 ENDIF
1280 ENDPROC
1290 :
1300 DEF PROCtd_showsquare(board%,i%,co
l%,usep%)
1310 LOCAL level%,row%,column%
1320 LOCAL xØ%,x1%,x2%,x3%,yØ%,y1%,y2%,
y3%,a%
1330 level%=i%>>4
1340 row%=(i%>>2) AND 3
1350 column%=i% AND 3
1360 PROCgcol(col%,board%,i%)
1370 IF usep% THEN
1380 PROCtd_getxy(level%,row%,column%,x
Ø%,yØ%)
1390 PROCtd_getxy(level%,row%+1,column%
,x1%,y1%)
1400 PROCtd_getxy(level%,row%+1,column%
+1,x2%,y2%)
1410 PROCtd_getxy(level%,row%,column%+1
,x3%,y3%)
1420 PROCgcol(col%,board%,i%)
1430 MOVE xØ%,yØ%
1440 MOVE x1%,y1%
1450 PLOT 85,x3%,y3%
1460 PLOT 85,x2%,y2%
1470 GCOL 6
1480 MOVE xØ%,yØ%
1490 DRAW x1%,y1%
1500 DRAW x2%,y2%
1510 DRAW x3%,y3%
1520 DRAW xØ%,yØ%
1530 ELSE
1540 RECTANGLE FILL td_lm%+td_sq%*colum
n%,128+td_sq%*(row%+4*level%)+16*level%,
td_sq%,td_sq%
1550 GCOL 6
1560 RECTANGLE td_lm%+td_sq%*column%,12
8+td_sq%*(row%+4*level%)+16*level%,td_sq
%,td_sq%
1570 ENDIF
1580 ENDPROC
1590 :
1600 DEF PROCtd_getxy(l%,r%,c%,RETURN x
%,RETURN y%)
1610 l%=info%!104+(25*l%+5*r%+c%)*8
1620 x%=!l%
1630 y%=l%!4
1640 ENDPROC
1650 :
1660 DEF PROCtd_getpersp(lev,x,y,RETURN
 xx,RETURN yy)
1670 xx=(x-2)*|(info%+99)+(y-2)*|(info%
+94)
1680 yy=(x-2)*|(info%+94)-(y-2)*|(info%
+99)
1690 x=-xx*64
1700 y=yy*64+1400
1710 xx=256+x*1400/y
1720 yy=1200+(lev*1.6-7.5)*120*1400/y
1730 IF lev=Ø yy-=32
1740 ENDPROC
1750 :
1760 DEF FNtd_init(info%)
1770 td_sq%=48
1780 td_lm%=(512-4*td_sq%)/2
1790 td_maxdepth%=32:REM absolute maxim
um depth
1800 td_movesize%=16:REM move size roun
ded up to word boundary
1810 td_maxmoves%=64:REM absolute maxim
um number of moves possible in a level
1820 td_movelist%=FNgetablock(td_movesi
ze%*td_maxdepth%*td_maxmoves%)
1830 td_stacksize%=&1000+64*td_maxdepth
%
1840 td_stack%=FNgetablock(td_stacksize
%)
1850 :
1860 td_code%=FNgetablock(&500)
1870 :
1880 td_fflg=1<<10
1890 :
1900 FOR pass%=Ø TO 2 STEP 2
1910 P%=td_code%
1920 [OPT pass%
1930 .initlistmoves
1940 MOV base2,#63
1950 MOV pc,link
1960 :
1970 .listonemove
1980 ORR link,link,#vbit
1990 STMFD (sp)!,{link}
2000 .listonemoveloop
2010 MOV val,#Ø
2020 LDRB temp2,[brd,base2]
2030 CMP temp2,#&FF
2040 BNE notpossible
2050 BL findmax
2060 CMP temp2,#2
2070 ADDEQ val,val,#&20
2080 ADDGT val,val,#&40
2090 TST level,#td_fflg
2100 BEQ notfrc
2110 CMP temp2,#3
2120 CMPNE temp,#3
2130 BNE notpossible
2140 .notfrc
2150 ADD temp,temp,#1
2160 CMP temp,#4
2170 ORREQ level,level,#winflg
2180 ADDEQ val,val,#&20000
2190 SUBEQ val,val,level,LSR #12
2200 ADDLT val,val,temp3
2210 ADR temp2,weight%
2220 LDRB temp2,[temp2,base2]
2230 ADD val,val,temp2
2240 ORR temp2,base2,temp,ASL #8
2250 TST level,#td_fflg
2260 BICNE level,level,#td_fflg
2270 ORRNE level,level,#frcflg
2280 CMP temp,#3
2290 ORREQ level,level,#frcflg
2300 ORREQ level,level,#td_fflg
2310 ORRGT level,level,#hltflg
2320 STR val,[bestptr],#4
2330 STR val,[bestptr],#4
2340 STR level,[bestptr],#4
2350 STR temp2,[bestptr],#4
2360 LDMFD (sp)!,{link}
2370 BIC link,link,#vbit
2380 SUBS base2,base2,#1
2390 BICPLS pc,link,#cbit
2400 ORRS pc,link,#cbit
2410 .notpossible
2420 SUBS base2,base2,#1
2430 BPL listonemoveloop
2440 LDMFD (sp)!,{link}
2450 ORRS pc,link,#cbit
2460 :
2470 .checksquare
2480 STMFD (sp)!,{link}
2490 ADR brd,td_board%
2500 MOV base2,RØ
2510 LDRB who,[brd,base2]
2520 BL findmax
2530 MOV RØ,temp
2540 LDMFD (sp)!,{pc}
2550 :
2560 .findmax
2570 STMFD (sp)!,{delta,R1,R2,link}
2580 MOV temp,#Ø
2590 MOV temp2,#Ø
2600 MOV temp3,#1
2610
2620 BIC base,base2,#%ØØØØ11
2630 MOV delta,#1
2640 BL countline
2650 BIC base,base2,#%ØØ11ØØ
2660 MOV delta,#4
2670 BL countline
2680 BIC base,base2,#%11ØØØØ
2690 MOV delta,#16
2700 BL countline
2710 ADR base,map%
2720 LDR R2,[base,base2,ASL #2]
2730 TST R2,#1<<Ø
2740 BICNE base,base2,#%ØØ1111
2750 MOVNE delta,#5
2760 BLNE countline
2770 TST R2,#1<<1
2780 BICNE base,base2,#%ØØ1111
2790 ADDNE base,base,#3
2800 MOVNE delta,#3
2810 BLNE countline
2820 TST R2,#1<<2
2830 BICNE base,base2,#%1111ØØ
2840 MOVNE delta,#2Ø
2850 BLNE countline
2860 TST R2,#1<<3
2870 BICNE base,base2,#%11ØØ11
2880 MOVNE delta,#17
2890 BLNE countline
2900 TST R2,#1<<4
2910 BICNE base,base2,#%1111ØØ
2920 ORRNE base,base, #%ØØ11ØØ
2930 MOVNE delta,#12
2940 BLNE countline
2950 TST R2,#1<<5
2960 BICNE base,base2,#%11ØØ11
2970 ORRNE base,base, #%ØØØØ11
2980 MOVNE delta,#15
2990 BLNE countline
3000 TST R2,#1<<6
3010 MOVNE base,#Ø
3020 MOVNE delta,#21
3030 BLNE countline
3040 TST R2,#1<<7
3050 MOVNE base,#3
3060 MOVNE delta,#19
3070 BLNE countline
3080 TST R2,#1<<8
3090 MOVNE base,#15
3100 MOVNE delta,#11
3110 BLNE countline
3120 TST R2,#1<<9
3130 MOVNE base,#12
3140 MOVNE delta,#13
3150 BLNE countline
3160 LDMFD (sp)!,{delta,R1,R2,pc}
3170 :
3180 .countline
3190 ADD base,base,brd
3200 MOV nval,#Ø
3210 MOV R1,#Ø
3220 ]
3230 FOR it%=1 TO 4
3240 [OPT pass%
3250 LDRB temp4,[base],delta
3260 CMP temp4,who
3270 ADDEQ nval,nval,#1
3280 CMPNE temp4,#&FF
3290 ADDNE R1,R1,#1
3300 ]
3310 NEXT it%
3320 [OPT pass%
3330 CMP nval,#Ø
3340 CMPNE R1,#Ø
3350 MOVNE pc,link
3360 CMP nval,#Ø
3370 MULNE temp3,nval,temp3
3380 CMP nval,temp
3390 MOVGT temp,nval
3400 CMP R1,temp2
3410 MOVGT temp2,R1
3420 MOV pc,link
3430 :
3440 .stale
3450 MOV pc,link
3460 :
3470 .move
3480 LDRB temp2,[temp,#12]
3490 STRB who,[brd,temp2]
3500 MOV pc,link
3510 :
3520 .unmove
3530 LDRB temp2,[temp,#12]
3540 MOV base2,#&FF
3550 STRB base2,[brd,temp2]
3560 MOV pc,link
3570 ]
3580 td_board%=P%:P%+=128
3590 weight%=P%:P%+=64
3600 map%=P%:P%+=256
3610 NEXT pass%
3620 FOR i%=Ø TO 63
3630 map%!(4*i%)=Ø
3640 NEXT
3650 PROCtd_makemap
3660 !info%=td_board%
3670 info%!4=move
3680 info%!8=unmove
3690 info%!12=initlistmoves
3700 info%!16=listonemove
3710 info%?20=1:REM Look ahead 1
3720 info%?21=4:REM Look ahead 2
3730 info%?22=3:REM lookahead mask
3740 info%?23=Ø
3750 info%?24=td_maxdepth%
3760 info%?25=1:REM stalemate not allow
ed
3770 info%!28=stale
3780 info%!32=512
3790 info%!36=1024
3800 info%!40=64
3810 info%!44=td_stack%+td_stacksize%
3820 info%!48=td_movelist%
3830 info%?52=2
3840 info%?53=2
3850 info%?54=4
3860 info%?55=16:REM move size
3870 info%?92=1:REM Perspective
3880 info%?93=Ø:REM angle of rotation
3890 |(info%+94)=SIN(Ø)
3900 |(info%+99)=COS(Ø)
3910 info%!104=FNgetablock(8*125)
3920 PROCtd_buildtab(info%)
3930 =TRUE
3940 :
3950 DEF PROCtd_buildtab(info%)
3960 IF info%?92=Ø ENDPROC
3970 LOCAL i%,level%,row%,column%,xØ,yØ
,x1,y1,a%,aa%
3980 a%=info%!104
3990 SYS "Hourglass_On"
4000 FOR level%=Ø TO 4
4010 FOR row%=Ø TO 4
4020 PROCtd_getpersp(level%,row%,Ø,xØ,y
Ø)
4030 PROCtd_getpersp(level%,row%,4,x1,y
1)
4040 x1=(x1-xØ)/4
4050 y1=(y1-yØ)/4
4060 FOR column%=Ø TO 4
4070 aa%=a%+8*(column%+5*row%+25*level%
)
4080 aa%!Ø=xØ+column%*x1
4090 aa%!4=yØ+column%*y1
4100 NEXT
4110 NEXT
4120 NEXT
4130 SYS "Hourglass_Off"
4140 ENDPROC
4150 :
4160 DEF PROCtd_makemap
4170 LOCAL i%,j%,w%
4180 FOR i%=Ø TO 3
4190 PROCtd_map(i%*16,5,Ø)
4200 PROCtd_map(i%*16+3,3,1)
4210 PROCtd_map(i%,20,2)
4220 PROCtd_map(i%*4,17,3)
4230 PROCtd_map(12+i%,12,4)
4240 PROCtd_map(3+i%*4,15,5)
4250 NEXT
4260 PROCtd_map(Ø,21,6)
4270 PROCtd_map(3,19,7)
4280 PROCtd_map(15,11,8)
4290 PROCtd_map(12,13,9)
4300 FOR i%=Ø TO 63
4310 w%=Ø
4320 FOR j%=Ø TO 9
4330 IF ((map%!(4*i%)) AND (1<<j%))>Ø w
%+=1
4340 NEXT
4350 weight%?i%=1<<w%
4360 NEXT
4370 ENDPROC
4380 :
```

```
4390 DEF PROCtd_map(a%,s%,b%)
4400 LOCAL i%
4410 FOR i%=0 TO 3
4420 map%!(4*a%)=(map%!(4*a%)) OR (1<<b
%)
4430 a%+=s%
4440 NEXT
4450 ENDPROC
4460 :
4470 DEF FNtd_gameover(info%)
4480 LOCAL winner%,A%
4490 winner%=-2
4500 IF info%?61=2 THEN
4510 winner%=-1
4520 ELSE
4530 FOR A%=0 TO 63
4540 IF ?(!info%+A%)<>&FF THEN
4550 IF USR(checksquare)=4 winner%=?(!i
nfo%+A%)
4560 ENDIF
4570 NEXT
4580 ENDIF
4590 =winner%
4600 :
4610 DEF FNtd_initgetmove(info%)=0
4620 :
4630 DEF FNtd_listmoves(info%)=0
4640 :
4650 DEF FNtd_unlistmoves(info%)=0
```

View Previewer

Listing 1

```
10 REM >PVsrce (VPreview1)
20 REM By David Lawrence
30 REM For BBC B/B+/M/C/E/!65Tube
40 REM (c) BAU July 1991
50 :
60 PROCinit
70 PROCcode
80 PROCchecksum
90 OSCLI"Save %.PreVIEW "+STR$~code+"
"+STR$~O%+" 400 400"
100 PRINT"Bytes free ";&500-P%
110 END
120 :
130 DEF PROCinit
140 DIM code 300
150 osword   = &FFF1
160 oswrch   = &FFEE
170 osasci   = &FFE3
180 style    = &F8
190 extended = &F9
200 vdus     = &90
210 char     = vdus + 1
220 :
230 under_bit  = &80
240 bold_bit   = &40
250 super_bit  = &04
260 sub_bit    = &02
270 italic_bit = &01
280 ENDPROC
290 :
300 DEF PROCcode
310 FOR pass = 4 TO 6 STEP 2
320 P% = &400:O% = code
330 [OPT pass
340 JMP writec
350 JMP init
360 RTS:BRK:BRK
370 RTS
380 .nostyle
390 STX style
400 RTS
410 .init
420 LDX #0
430 STX extended
440 BEQ nostyle
450 :
460 .setsub
470 ORA #sub_bit
480 BNE setfull
490 .setsuper
500 ORA #super_bit
510 .setfull
520 STA style
530 LDA char
540 BNE nochange
550 :
560 .toggleunder
570 LDA #under_bit
580 BNE toggle
590 .togglebold
600 LDA #bold_bit
610 BNE toggle
620 .toggleitalic
630 LDA #italic_bit
640 .toggle
650 EOR style
660 STA style
670 LDA char
680 BMI exit
690 BPL nochange
700 :
710 .writec
720 STA char
730 PHA
740 TXA : PHA
750 TYA : PHA
760 LDA char
770 CMP #&82
780 BEQ extend
790 CMP #&80
800 BCC plain
810 BNE togglebold
820 LDX extended
830 BEQ toggleunder
840 .extend
850 LSR A
860 LSR A
870 LDA extended
880 ROL A
890 ORA #&80
900 STA extended
910 BNE exit
920 :
930 .plain
940 LDX extended
950 BEQ nochange
960 LDA #0
970 STA extended
980 TXA
990 AND #&7F
1000 CMP #tabend-btable
1010 BCS illegal
1020 TAY
1030 LDA style
1040 AND #(super_bit OR sub_bit) EOR &F
F
1050 LDX btable,Y
1060 STX branch+1
1070 .branch
1080 BNE &400
1090 .illegal
1100 BRK : BRK : EQUS "?" : \ EQUB 0
1110 .btable
1120 EQUB 0
1130 EQUB 0
1140 EQUB setsub       -(branch+2)
1150 EQUB setsuper     -(branch+2)
1160 EQUB nochange     -(branch+2)
1170 EQUB toggleitalic -(branch+2)
1180 EQUB setfull      -(branch+2)
1190 EQUB togglebold   -(branch+2)
1200 EQUB reset        -(branch+2)
1210 .tabend
1220 :
1230 .reset
1240 JSR init
1250 .nochange
1260 CMP #13
1270 BNE realchar
1280 LDA style
1290 AND #(under_bit OR super_bit OR su
b_bit) EOR &FF
1300 STA style
1310 .print
1320 LDA char
1330 JSR osasci
1340 .exit
1350 PLA : TAY
1360 PLA : TAX
1370 PLA
1380 RTS
1390 :
1400 :
1410 .realchar
1420 LDX #char MOD 256
1430 LDY #char DIV 256
1440 LDA #10
1450 JSR osword
1460 LDY #0
1470 :
1480 LDA style
1490 AND #(super_bit OR sub_bit)
1500 BEQ nosquash
1510 LDX #8
1520 .squash
1530 LDA char,X
1540 ORA char-1,X
1550 PHA
1560 STY char,X
1570 STY char-1,X
1580 DEX
1590 DEX
1600 BNE squash
1610 LDA style
1620 AND #super_bit
1630 EOR #5
1640 TAX
1650 LDY #4
1660 .putback
1670 PLA
1680 STA char,X
1690 INX
1700 DEY
1710 BNE putback
1720 .nosquash
1730 :
1740 LDA style
1750 LSR A
1760 BCC notitalic
1770 LDX #3
1780 .doitalic
1790 LSR char,X
1800 ASL char+5,X
1810 DEX
1820 BNE doitalic
1830 .notitalic
1840 :
1850 BIT style
1860 BVC notbold
1870 LDX #8
1880 .dobold
1890 LDA char,X
1900 LSR A
1910 ORA char,X
1920 STA char,X
1930 DEX
1940 BNE dobold
1950 .notbold
1960 :
1970 BIT style
1980 BPL notunder
1990 LDA #&FF
2000 STA char+8
2010 .notunder
2020 :
2030 LDA #128
2040 STA char
2050 LDA #23
2060 STA vdus
2070 .defchar
2080 LDA vdus,Y
2090 JSR oswrch
2100 INY
2110 CPY #10
2120 BNE defchar
2130 BEQ print
2140 ]NEXT
2150 ENDPROC
2160 :
2170 DEF PROCchecksum
2180 total = 0
2190 FOR byte = code TO O%-1
2200 total = total + ?byte
2210 NEXT
2220 IF total = 32479 ENDPROC
2230 PRINT"Checksum error"
```

Pieces of 8

Listing 1

```
10 REM Random Landscapes (Po81)
20 REM Plot random landscapes
30 REM By Peter Batty
40 REM for all machines
50 REM (c) BAU July 91
60 :
70 MODE1
80 :
90 DIM yh%(64),op%(4),cf%(1)
100 :
110 op%(1)=143
120 op%(2)=0
130 op%(3)=179
140 op%(4)=0
150 :
160 VDU 19,0,6;0;19,1,4;0;
170 VDU 19,2,2;0;19,3,7;0;
180 :
190 VDU 5
200 CLG
210 :
220 REM This Segment Plots the Distant
Hills,Lake,
230 REM Middle and Foreground,then the
Road
240 :
250 k%=2-RND(3)
260 n%=50
270 ys%=635+k%*RND(n%)
280 PROChills(ys%,1,1,0,0)
290 :
300 ys%=ys%-(20+RND(n%))
310 PROChills(ys%,1,2,0,1)
320 :
330 ys%=ys%-(20+RND(n%))
340 k%=2-RND(3)
350 ck%=2-RND(2)
360 PROChills(ys%,2,3,k%,ck%)
370 :
380 ys%=ys%-RND(n%/4)
390 k%=2-RND(3)
400 ck%=2-RND(2)
410 PROChills(ys%,2,4,k%,ck%)
420 :
430 PROCroad(3,0)
440 :
450 REM This Segment Plots Various Siz
es and
460 REM Shades of Tree from Back to Fo
reground
470 :
480 n%=100
490 inc%=0
500 M=RND(150)
510 kz%=INT(RND(1)+0.5)
520 :
530 FOR ii%=1 TO M
540 inc%=inc%+RND(1000/M)
550 VDU 29,0;0;
560 xl=RND(1279)
570 iz%=xl/20
580 yl=yh%(iz%)-inc%+1
590 yt=(((yh%(iz%)-yl)/yh%(iz%))*n%+RN
D(20))*3
600 yh=yt/(2.0+RND(1))
610 xh=yh/(1.0+RND(1))
620 IF xh<4 THEN GOTO 560
630 IF POINT(xl-xh,yl)=3 THEN GOTO 560
640 IF POINT(xl,yl)=3 THEN GOTO 560
650 IF POINT(xl+xh,yl)=3 THEN GOTO 560
660 IF xh/yh<=1 THEN xb=yh*0.05 ELSE x
b=xh*0.05
670 :
680 yt=yt/40
690 yb=-yh*1.4
700 zc%=RND(3)
710 :
720 IF POINT(xl-xb,yl+yb)=3 THEN GOTO
560
730 IF POINT(xl+xb+yt,yl+yb-yt)=3 THEN
 GOTO 560
740 IF xl-xh<5 OR xl+xh>1275 THEN zc%=
1
750 IF yl-yh<5 THEN zc%=1
760 PROCtree(xh,yh,0,3)
770 xl=xl+yt
780 yl=yl-yt
790 t%=kz%*zc%
800 IF t%<=2 THEN PROCtree(xh,yh,0,1)
810 IF t%>2 THEN PROCtshade(xh,yh)
820 NEXT ii%
830 :
840 REM This Segment Switches the Colo
urs,
850 REM thus Simulating the Four Seaso
ns
860 :
870 REPEAT
880 RESTORE
890 FOR i%=1 TO 20
900 PROCdelay(500)
910 READ col0%,col1%,col2%,col3%
920 VDU 19,0,col0%;0;19,1,col1%;0;
930 VDU 19,2,col2%;0;19,3,col3%;0;
940 NEXT i%
950 UNTIL FALSE
960 END
970 :
980 REM PROChills Plots a Wave or Line
 of Colour
990 REM Constructing the Back to Foreg
rounds
1000 :
1010 DEF PROChills(ys%,col%,j%,k%,ck%)
1020 GCOL op%(j%),col%
1030 dt=RAD(10)
1040 th=RAD(RND(360))
1050 S=SIN(dt)
1060 C=COS(dt)
1070 ss=SIN(th)
1080 cc=COS(th)
1090 si=RND(100)
1100 yn%=ys%*ck%+(1-ck%)*(ys%+si*ss)
1110 MOVE 0,0
1120 MOVE 0,yn%
1130 yh%(0)=yn%
1140 :
1150 FOR i%=20 TO 1280 STEP 20
1160 sn=ss*C+cc*S
1170 cc=cc*C-ss*S
1180 ss=sn
1190 yn%=(yn%-k%*RND(5))*ck%+(1-ck%)*(y
s%+si*ss)
1200 yh%(i% DIV 20)=yn%
1210 PLOT 85,i%,0
1220 PLOT 85,i%,yn%
1230 NEXT i%
1240 ENDPROC
1250 :
1260 REM PROCroad Plots a Winding Road
based
1270 REM on a Sine Wave
1280 :
1290 DEF PROCroad(col%,j%)
1300 GCOL j%,col%
```

►

```
1310 ii=26+RND(10)
1320 inc=RND(2)
1330 yr%=yh%(ii)
1340 iz=ii*20
1350 si=60+RND(60)
1360 dt=RAD(20)
1370 th=RAD(0)
1380 S=SIN(dt)
1390 C=COS(dt)
1400 ss=SIN(th)
1410 cc=COS(th)
1420 ii=iz+si*ss
1430 MOVE ii,yr%
1440 MOVE ii+inc,yr%
1450 :
1460 FOR ij%=yr%-20 TO -20 STEP -20
1470 inc=inc+RND(2)
1480 sn=ss*C+cc*S
1490 cc=cc*C-ss*S
1500 ss=sn
1510 ii=iz+si*ss
1520 PLOT 85,ii,ij%
1530 ii=ii+inc
1540 PLOT 85,ii,ij%
1550 NEXT ij%
1560 ENDPROC
1570 :
1580 REM PROCtree Plots a Solid Ellipsoid Tree
1590 :
1600 DEF PROCtree(xx,yy,j%,col%)
1610 GCOL j%,col%
1620 VDU29,xl;yl;
1630 IF col%=1 AND RND(10)<=2 THEN GCOL j%,0
1640 dt=2*PI/15
1650 A=xx/yy
1660 C=COS(dt)
1670 S=SIN(dt)
1680 sx=S/A
1690 sy=S*A
1700 xa=xx
1710 ya=0
1720 MOVE 0,0
1730 MOVE xa,0
1740 :
1750 FOR i%=1 TO 15
1760 T=xa*C-ya*sy
1770 ya=ya*C+xa*sx
1780 xa=T
1790 PLOT 85,xa,ya
1800 MOVE 0,0
1810 NEXT i%
1820 :
1830 FOR i%=-xb TO xb STEP 4
1840 MOVE i%,0
1850 DRAW i%,yb
1860 NEXT i%
1870 ENDPROC
1880 :
1890 REM PROCtshade and PROCline Shades the Tree
1900 :
1910 DEF PROCtshade(xx,yy)
1920 col1%=INT(RND(1)+0.5)
1930 IF col1%=0 THEN col2%=1 ELSE col2%=0
1940 cf%(0)=col1%
1950 cf%(1)=col2%
1960 VDU 29,xl;yl;
1970 PROCline(0,yy,0,1)
1980 :
1990 FOR I=4 TO xx STEP 4
2000 J=yy*SIN(ACS(I/xx))
2010 k%=0
2020 kk%=1
2030 IF POINT(I-1,-J)=cf%(0) THEN k%=1:kk%=0
2040 PROCline(I,J,k%,kk%)
2050 PROCline(-I,J,k%,kk%)
2060 NEXT I
2070 :
2080 GCOL0,1
2090 FOR i%=-xb TO xb STEP 4
2100 MOVE i%,-yy
2110 DRAW i%,yb
2120 NEXT i%
2130 ENDPROC
2140 :
2150 DEF PROCline(X,Y,k%,kk%)
2160 GCOL0,cf%(k%)
2170 MOVE X,-Y
2180 PLOT 21,X,Y
2190 GCOL 0,cf%(kk%)
2200 MOVE X,-Y+4
2210 PLOT 21,X,Y
2220 ENDPROC
2230 :
2240 DEF PROCdelay(time%)
2250 LOCAL out%,now%
2260 out%=FALSE
2270 now%=TIME
2280 REPEAT
2290 IF INKEY$(0)<>"" THEN out%=TRUE
2300 IF TIME-now%>time% THEN out%=TRUE
2310 UNTIL out%=TRUE
2320 ENDPROC
2330 :
2340 REM This Data Holds Sets of Colour Numbers
2350 REM Defining Autumn,Winter,Spring and Summer
2360 :
2370 DATA 3,4,2,7,6,4,3,7,6,1,3,7,4,1,3,7,6,4,1,5
2380 DATA 6,4,7,5,6,4,7,0,4,4,7,0,5,4,7,0,4,4,7,0
2390 DATA 5,4,7,0,6,4,7,0,6,5,7,0,6,5,2,0,6,4,2,3
2400 DATA 6,4,2,7,6,4,2,3,6,4,2,7,3,4,2,7,6,4,2,7
```

Listing 2

```
10 REM 3D Pentominoes (Po82)
20 REM by David Lawrence
30 REM from an idea by Don Scales
40 REM for all machines
50 REM (c) BAU July '91
60 :
70 MODE 1
80 PROCscreen
90 PROCinit
100 PROCplay
110 IF more THEN RUN
120 MODE 7
130 *FX 229,0
140 END
150 :
160 DEF PROCplay
170 REPEAT
180 COLOUR 3
190 PRINT TAB(1,20);"Pos:(";xp;",";yp;",";zp;")"
200 IF old<>new PROCbox(old,0):PROCbox(new,3)
210 *FX 15
220 K$=GET$:old=new
230 IF error PRINT TAB(1,22);SPC11:error=FALSE
240 IF K$="," new=(new+11)MOD 12
250 IF K$="." new=(new+1)MOD 12
260 IF K$=" " PROCredraw
270 IF INSTR(rot$,K$) PROCrot(K$)
280 IF K$=CHR$136 PROCmove(xm-1,0,0)
290 IF K$=CHR$137 PROCmove(1,0,0)
300 IF K$=CHR$139 PROCmove(0,ym-1,0)
310 IF K$=CHR$138 PROCmove(0,1,0)
320 IF K$="_" PROCmove(0,0,zm-1)
330 IF K$="\" PROCmove(0,0,1)
340 IF K$=CHR$13 PROCplace
350 IF K$=CHR$127 PROCdelete
360 UNTIL used=12 OR K$="Q"
370 IF used=12 GCOL 0,1:VDU 5:MOVE 48,335:PRINT "Well done!":VDU4
380 PRINT TAB(1,23);"Another go?"
390 *FX 15
400 more=((GET AND &DF)=ASC"Y")
410 ENDPROC
420 :
430 DEF PROCplace
440 IF num=-1 PROCer("No shape"):ENDPROC
450 err=FNfit
460 IF err=1 PROCer("Outside box")
470 IF err=2 PROCer("Overlaps")
480 IF err=0 PROCputit
490 ENDPROC
500 :
510 DEF FNfit
520 F%=TRUE
530 FOR b%=1 TO 5
540 PROCextract(C%(num,b%))
550 IF xp+x<0 OR xp+x>=xm F%=FALSE
560 IF yp+y<0 OR yp+y>=ym F%=FALSE
570 IF zp+z<0 OR zp+z>=zm F%=FALSE
580 NEXT
590 IF NOT F% THEN =1
600 F%=TRUE
610 FOR b%=1 TO 5
620 PROCextract(C%(num,b%))
630 IF G%(xp+x,yp+y,zp+z) F%=FALSE
640 NEXT
650 IF NOT F% THEN =2
660 =0
670 :
680 DEF PROCputit
690 VDU 28,1,16,11,6,12,26
700 PROCshape(num,1)
710 FOR b%=1 TO 5
720 PROCextract(C%(num,b%))
730 G%(xp+x,yp+y,zp+z)=num+1
740 NEXT
750 PROCshowall
760 C%(num,0)=1
770 num=-1:used=used+1
780 ENDPROC
790 :
800 DEF PROCer(t$)
810 COLOUR 1:PRINT TAB(1,22);t$
820 SOUND 1,-10,201,1:error=TRUE
830 ENDPROC
840 :
850 DEF PROCdelete
860 IF C%(new,0)=0 PROCer("Not used"):ENDPROC
870 FOR xx=0 TO xm-1
880 FOR yy=0 TO ym-1
890 FOR zz=0 TO zm-1
900 IF G%(xx,yy,zz)=new+1 G%(xx,yy,zz)=0
910 NEXT
920 NEXT
930 NEXT
940 PROCshape(new,2)
950 PROCshowall
960 C%(new,0)=0:used=used-1
970 ENDPROC
980 :
990 DEF PROCshowall
1000 VDU 28,15,23,38,6,12,26
1010 PROCbase(xm,ym,zm)
1020 FOR zq=0 TO zm-1
1030 FOR yq=0 TO ym-1
1040 FOR xq=0 TO xm-1
1050 IF G%(xq,yq,zq) PROCcube(xq,yq,zq)
1060 NEXT
1070 NEXT
1080 NEXT
1090 PROCoutline(xm,ym,zm,3)
1100 PROCcurs(xp,yp,zp)
1110 ENDPROC
1120 :
1130 DEF PROCmove(xa,ya,za)
1140 PROCcurs(xp,yp,zp)
1150 xp=(xp+xa)MOD xm
1160 yp=(yp+ya)MOD ym
1170 zp=(zp+za)MOD zm
1180 PROCcurs(xp,yp,zp)
1190 ENDPROC
1200 :
1210 DEF PROCcurs(xc,yc,zc)
1220 PROC3d(4,xc+1,yc+1,zc)
1230 GCOL 3,1:PRINT out$;
1240 ENDPROC
1250 :
1260 DEF PROCbox(pos,col)
1270 GCOL 0,col
1280 MOVE 63+pos*6*16,63
1290 PLOT 1,84,0:PLOT 1,0,84
1300 PLOT 1,-84,0:PLOT 1,0,-84
1310 ENDPROC
1320 :
1330 DEF PROCredraw
1340 IF C%(new,0)=1 PROCer("Shape Used"):ENDPROC
1350 VDU 28,1,15,11,6,12,26
1360 num=new
1370 PROCdraw(num,-5,6,1)
1380 ENDPROC
1390 :
1400 DEF PROCrot(dir$)
1410 IF num=-1 PROCer("No Shape"):ENDPROC
1420 VDU 28,1,16,11,6,12,26
1430 dir$=CHR$(ASC(dir$)AND&DF)
1440 IF INKEY-1 dir$=dir$+"a"
1450 FOR b%=1 TO 5
1460 PROCextract(C%(num,b%))
1470 C%(num,b%)=EVAL("FNrot"+dir$)
1480 NEXT
1490 PROCdraw(num,-5,6,1)
1500 ENDPROC
1510 :
1520 DEF FNrotX=(2+y)*100+(2-z)*10+2+x
1530 DEF FNrotY=(2-x)*100+(2+y)*10+2+z
1540 DEF FNrotZ=(2+z)*100+(2+x)*10+2-y
1550 DEF FNrotXa=(2-y)*100+(2+z)*10+2+x
1560 DEF FNrotYa=(2+x)*100+(2+y)*10+2-z
1570 DEF FNrotZa=(2+z)*100+(2-x)*10+2+y
1580 :
1590 DEF PROCbase(xo,yo,zo)
1600 GCOL 0,3
1610 PROC3d(4,xo,0,0)
1620 PROC3d(21,0,0,0)
1630 PROC3d(21,0,yo,0)
1640 PROC3d(4,0,0,0)
1650 PROC3d(21,0,0,zo)
1660 ENDPROC
1670 :
1680 DEF PROCoutline(xo,yo,zo,col)
1690 GCOL 0,col
1700 RESTORE 3200
1710 FOR z%=1 TO 11
1720 READ p%,xa,ya,za
1730 PROC3d(p%,xo*xa,yo*ya,zo*za)
1740 NEXT
1750 ENDPROC
1760 :
1770 DEF PROCdraw(n,xx,yy,zz)
1780 FOR I%=1 TO 5
1790 A%(I%)=C%(n,I%)
1800 NEXT
1810 FOR I%=1 TO 5:L%=I%
1820 FOR J%=I% TO 5
1830 IF A%(J%)<A%(L%) L%=J%
1840 NEXT
1850 B%=A%(L%):A%(L%)=A%(I%):A%(I%)=B%
1860 PROCextract(B%)
1870 PROCcube(x+xx,y+yy,z+zz)
1880 NEXT
1890 ENDPROC
1900 :
1910 DEF PROCcube(xc,yc,zc)
1920 PROC3d(4,xc,yc,zc)
1930 PRINT cube$;
1940 GCOL 0,0
1950 IF ABSx+ABSy+ABSz<>0 PRINT out$;
1960 ENDPROC
1970 :
1980 DEF PROC3d(o%,x,y,z)
1990 PLOT o%,736+(x-y)*xs,640-(x+y)*ys+z*zs
2000 ENDPROC
2010 :
2020 DEF PROCscreen
2030 VDU 23;8202;0;0;0;
2040 PROCdrop(12,3,27,1)
2050 PRINT TAB(13,2);"3D Pentominoes"
2060 PROCdrop(1,16,11,6)
2070 PROCdrop(15,23,38,6)
2080 PROCdrop(1,23,11,19)
2090 PROCdrop(1,30,38,26)
2100 ENDPROC
2110 :
2120 DEF PROCinit
2130 DIM C%(11,5),A%(5)
2140 xs=48:ys=24:zs=48:used=0:num=0
2150 xp=0:yp=0:zp=0:new=0:old=1
2160 rot$="XYZxyz":error=FALSE
2170 GCOL 0,2:*FX 4,1
2180 *FX 229,1
2190 FOR I%=0 TO 11
2200 FOR J%=1 TO 5
2210 READ V%
2220 C%(I%,J%)=V%*10+2
2230 PROCdot(I%*6+V%MOD 10,(V%/10)MOD 10)
2240 NEXT
2250 NEXT
2260 VDU 28,15,23,38,6
2270 PRINT'"    Select grid size:"
2280 PRINT'" 1)  5 x 4 x 3"'" 2)  6 x 5 x 2"'" 3) 10 x 3 x 2"
2290 PRINT''" - Which ? ";
2300 REPEAT
2310 k$=GET$
2320 UNTIL k$>"0" AND k$<"4"
2330 IF k$="1" xm=5:ym=4:zm=3
2340 IF k$="2" xm=6:ym=5:zm=2
2350 IF k$="3" xm=10:ym=3:zm=2
2360 DIM G%(xm,ym,zm)
2370 VDU 12,26
2380 cube$=FNstring
2390 out$=FNstring
2400 PROCbase(xm,ym,zm)
2410 PROCoutline(xm,ym,zm,3)
2420 PROCdraw(0,-5,6,1)
2430 PROCcurs(0,0,0)
2440 ENDPROC
2450 :
2460 DEF FNstring
2470 st$=""
2480 REPEAT
2490 READ v%,v1%,v2%
2500 IF v%=18 THEN PROCgcol
2510 IF v%=0 OR v%=1 OR v%=81 PROCplot
2520 UNTIL v%=-1
2530 =st$
2540 :
2550 DEF PROCgcol
2560 st$=st$+CHR$18+CHR$v1%+CHR$v2%
2570 ENDPROC
2580 :
2590 DEF PROCplot
2600 st$=st$+CHR$25+CHR$v%+FNc(v1%)+FNc(v2%)
2610 ENDPROC
2620 :
2630 DEF FNc(q%)
2640 q%=q%+65536
2650 =CHR$(q% MOD 256)+CHR$(q% DIV 256)
2660 :
2670 DEF PROCshape(n,c)
2680 GCOL 0,c
2690 RESTORE
2700 IF n<>0 FOR i=1 TO n*5:READ q:NEXT
2710 FOR i=1 TO 5
2720 READ V%
2730 PROCdot(n*6+V%MOD10,(V%/10)MOD10)
2740 NEXT
2750 ENDPROC
2760 :
2770 DEF PROCdot(xd,yd)
2780 MOVE 64+xd*16,64+yd*16:PLOT 1,15,0
2790 PLOT 81,-15,15:PLOT 81,15,0
2800 ENDPROC
2810 :
2820 DEF PROCextract(zyx)
2830 x=zyx MOD 10-2
2840 y=(zyx/10) MOD 10-2
2850 z=(zyx/100) MOD 10-2
2860 ENDPROC
2870 :
2880 DEF PROCdrop(l,d,r,u)
2890 l=l*32:d=991-d*32:r=(r+1)*32
2900 u=1023-u*32
2910 VDU18,0,131,24,l;d-12;r+12;u;16
2920 VDU18,0,128,24,l+4;d-8;r+8;u-4;16
2930 VDU18,0,131,24,l-8;d-4;r+4;u+8;16
2940 VDU18,0,128,24,l-4;d;r;u+4;16,26
2950 ENDPROC
2960 :
2970 DATA 02,12,22,32,42
2980 DATA 11,12,22,32,42
2990 DATA 21,12,22,32,42
3000 DATA 11,21,22,32,42
3010 DATA 11,21,22,12,32
3020 DATA 20,21,22,12,32
3030 DATA 21,12,22,23,33
3040 DATA 21,31,22,23,33
3050 DATA 11,21,22,23,33
3060 DATA 20,21,22,32,42
3070 DATA 21,12,22,32,23
3080 DATA 11,21,22,32,33
3090 :
3100 DATA 18,0,1, 0,-xs,-ys, 0,xs,-ys
3110 DATA 81,-xs,ys*3, 81,xs,-ys
3120 DATA 18,0,3, 81,0,ys*2, 81,xs,-ys
3130 DATA 18,0,2, 0,-xs,-ys, 81,xs,-ys
3140 DATA 81,-xs,-ys, -1,0,0
3150 DATA 1,xs,ys, 1,0,2*ys, 1,-xs,ys
3160 DATA 1,-xs,-ys, 1,0,-2*ys
```

```
3170 DATA 1,xs,-ys, 1,0,2*ys, 1,xs,ys
3180 DATA 0,-xs,-ys, 1,-xs,ys, -1,0,0
3190 :
3200 DATA 4,1,1,0, 5,1,0,0
3210 DATA 5,1,0,1, 5,0,0,1
3220 DATA 5,0,1,1, 5,0,1,0
3230 DATA 5,1,1,0, 5,1,1,1
3240 DATA 5,1,0,1, 4,1,1,1
3250 DATA 5,0,1,1
```

Listing 3

```
  10 REM String Scroller (Po83)
  20 REM Scroll down, not along
  30 REM By Murray MacKenzie
  40 REM For all machines
  50 REM (c) BAU July 91
  60 :
  70 MODE 6
  80 VDU 23;8202;0;0;0;
  90 :
 100 REPEAT
 110 PROCscroll("Demonstration...",10,1
0)
 120 UNTIL FALSE
 130 :
 140 DEF PROCscroll(S$,x,y)
 150 VDU31,x,y
 160 A%=10:X%=&70:Y%=0
 170 FOR char=1 TO LEN(S$)
 180 X%?0=ASC(MID$(S$,char,1)):CALL&FFF
1
 190 FOR line=1 TO 8
 200 VDU 23,224
 210 FOR lev=9-line TO 8
 220 VDU X%?lev
 230 NEXT lev
 240 FOR space=1 TO 8-line
 250 VDU 0
 260 NEXT space
 270 VDU 31,(x+char-1),y
 280 VDU 224
 290 NEXT line
 300 NEXT char
 310 VDU 10,13
 320 ENDPROC
```

Listing 4

```
  10 REM Scrolling Message (Po84)
  20 REM Change from one string to anot
her
  30 REM By Murray MacKenzie
  40 REM For all machines
  50 REM (c) BAU Jul 91
  60 :
  70 MODE 6
  80 VDU 23,1,0;0;0;0;
  90 PRINT TAB(10,10)"Demonstration"
 100 PRINT TAB(12,20);"Hit Space"
 110 REPEAT UNTIL GET=32
 120 PRINT TAB(12,20);"         "
 130 PROCchange("Demonstration","Of Cha
nging",10,10)
 140 PROCchange("Of Changing","Strings.
",10,10)
 150 PRINT
 160 END
 170 :
 180 DEF PROCchange(old$,new$,x,y)
 190 A%=10:oldloc%=&70:newloc%=&900
 200 oldblock%=&60
 210 newblock%=&70
 220 old=LEN(old$):new=LEN(new$)
 230 IF old>new THEN len=old ELSE len=n
ew
 240 FOR char=1 TO len
 250 FOR line=0 TO 8
 260 X%=oldblock% MOD 256
 270 Y%=oldblock% DIV 256
 280 oldblock%?0=ASC(MID$(old$,char,1))
 290 CALL &FFF1
 300 X%=newblock% MOD 256
 310 Y%=newblock% DIV 256
 320 newblock%?0=ASC(MID$(new$,char,1))
 330 CALL &FFF1
 340 VDU 23,224
 350 IF line=0 THEN 400
 360 FOR newlev=9-line TO 8
 370 VDU newblock%?newlev
 380 NEXT newlev
 390 IF line=8 THEN 450
 400 VDU 0
 410 IF line=7 THEN 450
 420 FOR oldlev=1 TO 7-line
 430 VDU oldblock%?oldlev
 440 NEXT oldlev
 450 VDU 31,x+char-1,y,224
 460 NEXT line
 470 NEXT char
 480 ENDPROC
```

Comms

Listing 1

```
  10 REM >Term2 (Comms1)
  20 REM Simple Computer to Computer li
nk
  30 REM by Paul Vigay
  40 REM for all machines with serial p
orts
  50 REM (c) BAU July 91
  60 :
  70 ON ERROR GOTO 530
  80 *FX4,2
  90 *FX2,2
 100 *FX5,2
 110 *FX6
 120 *FX7,7
 130 *FX8,7
 140 *FX15,0
 150 MODE1
 160 COLOUR2:PRINT"Outgoing messages"
 170 COLOUR1:PRINTTAB(0,15);STRING$(40,
"=");
 180 COLOUR2:PRINT"Incoming messages"
 190 COLOUR3:VDU19,0,4;0;
 200 :
 210 RX%=0:RY%=0:TX%=0:TY%=0
 220 :
 230 REPEAT
 240 VDU28,0,31,39,18,31,RX%,RY%
 250 PROCreceive
 260 RX%=POS:RY%=VPOS
 270 VDU28,0,14,39,2,31,TX%,TY%
 280 PROCtransmit
 290 TX%=POS:TY%=VPOS
 300 UNTIL FALSE
 310 :
 320 DEF PROCreceive
 330 *FX2,1
 340 G%=INKEY(0)
 350 PROCoutchar(G%)
 360 *FX2,2
 370 ENDPROC
 380 :
 390 DEF PROCtransmit
 400 *FX2,2
 410 *FX3,10
 420 G%=INKEY(0)
 430 IF NOT G% VDU G%
 440 *FX3,0
 450 PROCoutchar(G%)
 460 ENDPROC
 470 :
 480 DEF PROCoutchar(G%)
 490 IF G%>31 AND G%<128 VDU G%
 500 IF G%=13 PRINT
 510 ENDPROC
 520 :
 530 REM An error has occured !
 540 ON ERROR OFF
 550 MODE 7
 560 *FX3,0
 570 *FX2,0
 580 *FX4,0
 590 REPORT:PRINT" at line ";ERL
```

Fill this space.

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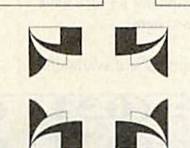
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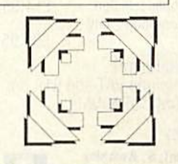
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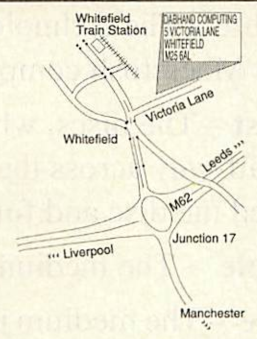
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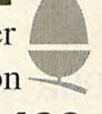
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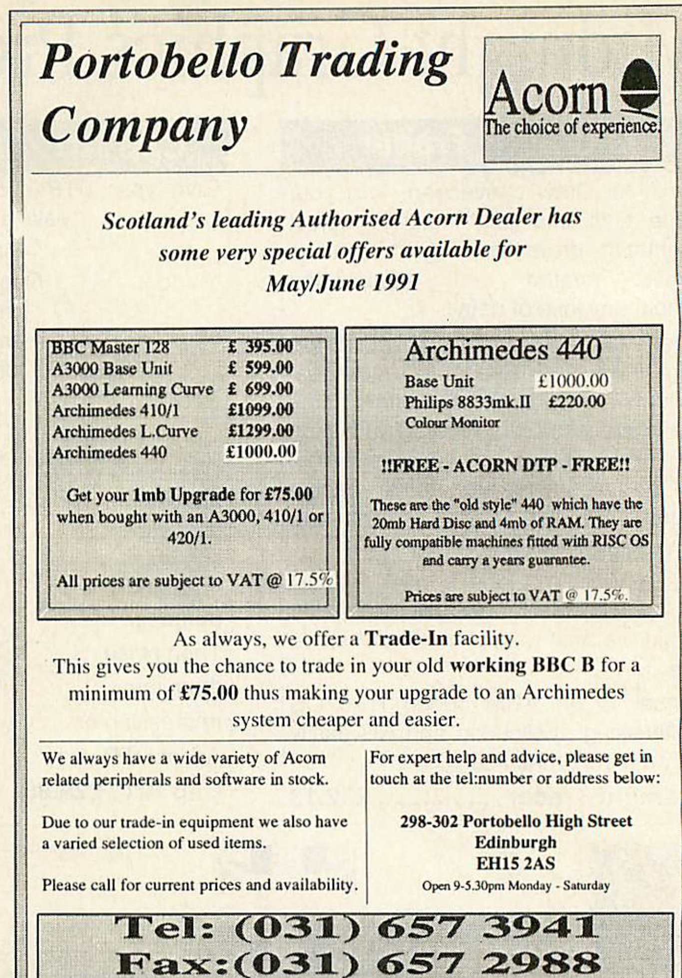









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THE DOTTED NINE

MALCOLM BROWN compares some low cost nine-pin printers currently available

No matter how attractive a laser printer, or even good quality 24-pin dot-matrix printer, if your budget only runs to £250, a nine-pin dot-matrix model is for you.

These printers remain ever popular because they provide workhorse printing. For a hard copy of program listings, file copies of accounts or draft copies of documents, a more expensive printer is not really what you need.

In such cases the quality of either the draft or near letter quality (NLQ) print is not so important. So long as the text is legible and comfortable to read, its finer aesthetic points are unimportant. It is speed that matters. All the models looked at here have been tested by printing a set piece of text and the equivalent speed in characters per second (cps) calculated.

Our cps performance figures are more realistic than those claimed by the manufacturers and can be compared with those quoted in previous *BAU* printer tests.

The commands to control effects, such as bold, enlarged, condensed, italic print, and so on, follow a number of different standards. The basic facilities are provided by the Epson FX and IBM Graphics Printer standards. Epson LQ and IBM Proprinter standards offer more versatility and are worth looking out for.

The seven printers reviewed here all cost less than £260. In addition, there is a comparison table which allows you to compare these printers with eight slightly more expensive models. From this table you will be able to decide which printer will be the best for you.

AMSTRAD DMP3160

This £175 printer is aimed particularly at users of Amstrad's CPC range of home computers. It is not strongly made nor elegantly styled, mainly because of the somewhat peculiar paper feeding mechanism.

Paper enters the printer from the front, not the back or base like most printers. For cut sheet paper this means it is loaded face up – unusual and tricky to get used to at first, but actually quite sensible. Since the paper meets the printhead almost as soon as it enters the printer, there's no need for automatic loading.

Fanfold paper also enters from the front and the DMP3160 has a pair of fold-down feet to raise the printer a few inches off the desk so a (small) wad of fanfold paper can sit beneath it.

The print from this model is not of a very good quality. In draft mode text is faint and unattractive, although in NLQ mode it is better, but not up to the standard expected.

It is also exceptionally slow – in draft mode it barely manages a snail-like 67cps, which is around 45sec per page.

In NLQ mode the DMP3160 sinks to a derisory 18cps, which is the speed of a cheap daisywheel printer – although the quality of NLQ print from the DMP3160 is not as good.

The DMP3160 is, however, IBM Proprinter compatible and can also emulate the Epson LQ series. The DMP3160 is certainly cheap. Few other printers come near this price, although those that do, more than justify the extra.

EPSON LX-400

At £199, the LX-400 is not only extremely cheap, but it beats the pants off machines costing twice as much.

The paper handling system features that bugbear, the removable tractor feed, which must be removed to use single sheet paper – time consuming and wearing on the fittings.

It is also a pull-feed unit, and so wasteful on fanfold paper as well. For cut sheet paper the automatic loading is fast and efficient, but there is no paper parking.

The print quality from this machine is excellent. NLQ text is dark, crisp and well formed with dark areas of graphics and graphics characters dark and even. Draft print is naturally less appealing, but it is still easily readable.

The LX-400 is relatively fast – in draft mode it manages a healthy 101cps, and 23cps in NLQ, which is just under 2min per page.

Unfortunately, there is no IBM standard at all, although the LX-400 is Epson-compatible with a standard roughly equivalent to the FX standard, but with the full IBM character set provided.

Overall, the LX-400 is a well made, flexible printer which performs well beyond its selling price.

MT81

At £187, the Mannesmann Tally MT81 is one of the cheapest printers available, but is also capable of high quality.

A push-feed tractor unit is built-in, but no paper parking is provided. Cut sheets are not loaded automatically and the only way to straighten a sheet after it is loaded is to briefly switch to tractor feed to release the hold on the paper.

However, this machine is not really intended for frequent use with cut sheet paper – it is strictly a fanfold printer.

The print from the MT81 is well above average. Draft print is dark and relatively dot-free – better than many models' attempts at NLQ. In NLQ mode the MT81 produces dark, even, crisp and rounded

characters. The only drawback is that only one NLQ font is provided and that print is a touch heavy.

The speed of the MT81 is decidedly average. Draft print is produced at about 77cps and NLQ characters are printed at a rate of 21cps – over 2min per page. However, the MT81 is both Epson FX and IBM Proprinter compatible and most functions can be controlled from the front panel, albeit mostly with complicated and sometimes hard-to-remember button combinations.


MANNESMANN MT81

There is not a great deal to set the MT81 apart except its price, and plenty of discounts bring superior models down to this level.

OLIVETTI DM109

This is a push feed type and it sits recessed into the top of the printer. A tear-off function advances the paper to tear off the sheet and then retracts it back again to print the next one.

Cut sheet paper is loaded automatically at the press of a button – the same button will also attempt to 'park' fanfold paper even when no fanfold paper is in the printer and it is set to friction feed. So, pressing the wrong button promptly ejects, backwards, the sheet of paper just loaded.

Draft print is relatively poor and, although readable, a long document can be quite a strain. NLQ print is better but not even up the standard of the Amstrad DMP3160.

There are two NLQ fonts available – a typewriter lookalike and a plain sans serif font. NLQ print is produced at the reasonable rate of 25cps, but draft print is tardy at just 80cps. To compensate, a high speed draft mode produces characters at a good rate of 119cps, but the print quality suffers enormously.

High speed print cannot be selected from the front panel or with a software code – only in the complex initial set up, involving long chains of printed menus. Character pitch and draft/NLQ can be selected from the front panel and other functions are controlled with either IBM Proprinter or Epson FX commands.


OLIVETTI DM109

Olivetti's tradition of quality is seriously let down by the DM109 – a slow, poor quality machine which cannot justify even this low price.

PANASONIC KX-P1081

As something of a forerunner to the KX-P1180, the £257 KX-P1081 is a bit of a classic. This is an old design, owing much to the original Epson FX-80 'look' of around eight years ago. It is rather noisy in use, producing a loud buzzing sound as it prints.

Both tractor and friction feed units are provided but there are no luxuries, such as paper parking. The paper handling is let down by the automatic paper feed, which operates as soon as a sheet is placed into the printer.

But, as there are no proper guides, it almost invariably feeds crooked – no automatic loading at all would be a lot easier to use.

The print quality from this machine is crisp, dark and eminently readable. The KX-P1081 has just one NLQ font available – the usual typewriter lookalike.

In speed, the KX-P1081 will manage 77cps – about 30sec for a typical page of text and a bit slow for this price. In NLQ mode the speed is down to 20cps, again at the lower end of the scale.

Only the basic Epson FX and IBM Graphics Printer emulations are provided and print quality can be selected from a switch on the front panel, although switching to NLQ makes it impossible to switch back to draft print with a software command.

The KX-P1081 is a simple machine with little in the way of extra frills but it is robust and capable of quite reasonable print.


PANASONIC KX-P1080

However, the opposition provided by Panasonic (see table) is faster, easier to use and offers a choice of NLQ fonts. Few (least of all Panasonic) would deny that if the extra £50 can be found, the KX-P1180 provides a much better solution.

SEIKOSHA SP-2000

Unlike other Seikosha printers, the SP-2000 model looks more expensive than its £234 price tag. It is mostly a very clever styling job but this machine appears capable of far rougher treatment than it probably is (although as a whole, I would say it is fairly robust).

Paper feed is straightforward. Both fanfold and cut sheet paper enter and exit the printer on the top. Cut sheet paper is loaded automatically, triggered by the bail bar, and fanfold paper is handled with a push-only tractor.

The print from the SP-2000 is exceptionally dark, especially in NLQ mode. In draft mode, the characters are clear and easily legible, much like the Swift 9 in both style and quality.

In NLQ mode the text, although rather pixelated around the edges, is extremely clear and crisp, with even large areas of black in graphics printed a deep, even black.

There are two NLQ fonts available – a serif typewriter lookalike and a sans serif style, which is a small but powerful combination that will satisfy most needs.

For its relatively low price, the SP-2000 is faster than average. In draft mode it manages a slightly disappointing 97cps. NLQ text, however, is produced at 25cps – a very reasonable speed for this price.


SEIKOSHA SP-2000

The SP-2000 can emulate both an IBM Proprinter and Epson FX printer, and some control is also possible from the front panel. The quality of print – NLQ or draft – can be selected from here, as can the NLQ font used.

The Seikosha SP-2000 is quite a bargain. Although it is not overtly fast, it is well made and produces good NLQ print in a choice of two fonts.

STAR LC-10 II

The Star LC-10 was (and still is) an excellent machine and the £257 LC-10 II continues the tradition. It is not the cheapest machine available, but it packs in many features.

Both friction and tractor feed are provided with the push-feed tractor feed hidden away under a back panel when not in use. The LC-10 II also features automatic paper loading and paper parking.

But most important is the print quality from this printer. Draft print is extremely readable, if a little faint. The NLQ quality is simply excellent – far better than other machines of this price. The letters are well styled and crisp and dark.

The LC-10 II can print in four NLQ character styles. As

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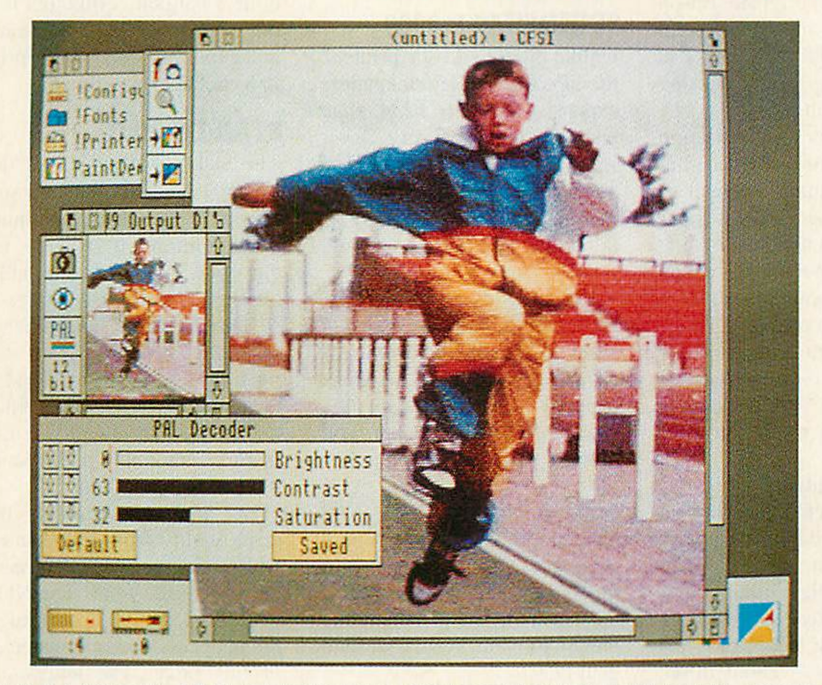
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NINE-PIN PRINTER COMPARISON TABLE

Make & Model	Price (exVAT)	Claimed speed Draft	NLQ	Average speed Draft	NLQ	Interfaces Centr	RS232	Tractor Feed	Sheet Feeder	Paper Parking	Compatibility Epson	IBM	NLQ styles
Amstrad DMP3160	£149	160	40	67	18	●	●	Push	-	-	LQ	Pro	1
Brother M-1309	£239	180	45	111	28	●	-	Push/pull	-	●	FX	Pro	4
Citizen Swift9	£269	160	40	108	29	●	£30	Push/pull	£84	●	FX	Pro	3
Epson FX-850	£459	290	45	175	44	●	£36	Push	£165	●	FX	Pro	2
Epson LX-400	£169	150	25	101	23	●	£36	Push	£79	-	LQ	Pro	2
IBM ProprinterIII	£477	270	65	174	45	●	£48	Push	£155	●		Pro	2
Mannesmann TallyMT81		£159	130	24	77	21	●	£40	Push	£82	-	FX	Pro 1
Olivetti DM105S	£249	150	30	86	20	●	-	Pull	£99	-	FX	Pro	2
Olivetti DM109	£219	200	30	80	25	●	-	Push	-	●	FX	Pro	1
Olympia NP30	£248	130	26	84	21	●	£25	Push	£138	-	FX	Pro	1
Panasonic KX-P1081	£219	120	24	77	20	●	£41	Push	-	-	FX	Gra	1
Panasonic KX-P1180	£269	160	32	103	25	●	£69	Push/pull	£99	●	FX	Pro	4
Seikosha SP-2000	£199	160	40	97	25	●	●	Push	-	●	FX	Pro	2
Star LC-10II	£219	150	38	101	39	●	£55	Push	£65	●	FX	Pro	4
Star LC-200	£259	160	45	100	30	●	£55	Push/pull	£65	●	FX	Pro	4

well as the usual typewriter lookalike, this machine can produce san serif and (two) Orator fonts.

A big attraction of the LC-10 II is its speed. In draft mode it can manage 101cps, while in NLQ its speed is an impressive 29cps. The LC-10 II is both Epson FX and IBM Proprinter compatible so there are numerous printing effects to be used with most software.

The style and size of the print can be controlled from the front panel and other printing effects can also be switched on from here but only with complicated button combinations.

The old Star LC-10 was a successful design but Star has improved it still further. The speed has been increased to an impressive level and the print quality is of the same excellent standard.

CONCLUSION

Now let's sort out the sheep from the lambs. Although it is the cheapest, the Amstrad DMP3160 performs so badly, it is hardly worth considering with any seriousness.

Next up the scale is the Mannesmann Tally MT81. This was considered excellent when it was launched, but has now been somewhat overtaken by newer models from other manufacturers, not least the LX-400 from Epson.

The LX-400 is truly amazing value for money. It produces good quality print at a reasonable speed. At this price there is nothing to beat it.

Around the £220 mark the Panasonic KX-P1081 suffers from its old age. Things have moved on since this printer was conceived. Likewise the Olivetti DM105S is looking rather long in the tooth. However, the Seikosha SP-2000 shows what a newer model can do.

Walking off with the crown of the cheaper dot-matrix printers, however, must be the Star LC-10 II. With excellent quality NLQ print and good speed in both NLQ and draft, a choice of four fonts and many convenience features, this printer gives many costing far more a run for their money.

GOOD LOOKING

The graphics performance of the Archimedes is already exceptional. Even the best can be improved, though, as **SIMON WILLIAMS** has been finding out

The Archimedes has always been strong on graphics. The VIDC chip provides a wide range of resolutions and colour selections from a large palette. Nonetheless, the machine was designed over five years ago, and standards in all areas of computing continue to advance apace.

Several graphics cards for machines like the Apple Macintosh and the IBM PC can now offer graphic modes which include a full 24-bit palette, or 16,777,216 colours.

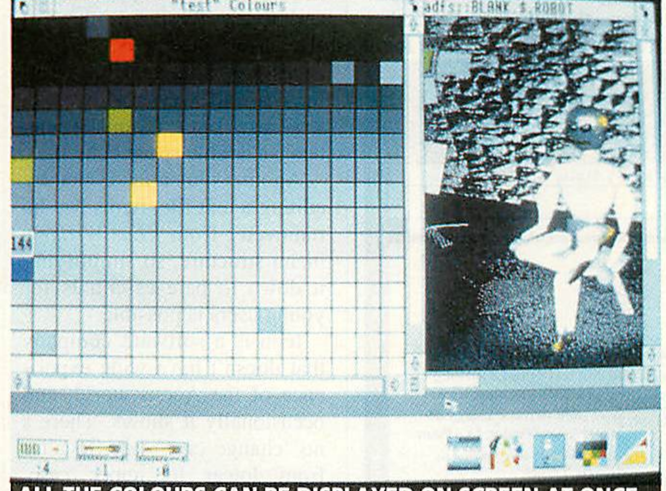
The PCATS graphics enhancer for the Archimedes/A3000 machines offers the same state-of-the-art colour palette, and a number of new, high resolution graphics modes for under £200. The enhancer brings a lot of extra graphics power to the Archimedes with minimum disturbance to its existing operation.

The hardware consists of a half-width podule which connects to the Arc's main board via the genlock connector, and to the standard analogue output of the machine via a short loop cable. Monitor output is then taken from an identical analogue socket on the enhancer back panel. The board itself is well made and tightly packed with the Hitachi graphics processor chip, crystal oscillators and sockets for extra ones, and logic chips as well as miniature relays. The rear panel has two analogue video sockets mounted on it, for input of the Arc's standard video signal and output from the enhancer.

Although installation is not complex, it does involve soldering a new header to the genlock output, which in turn means removing the main board from the Archimedes' case. For this reason, the unit has to be fitted by The Serial Port, which offers a courier collection and delivery service.

Once the enhancer has been fitted, you have a number of new graphics modes directly available to you.

For a start, all the Computer Concepts and Atomwide graphics modes are pre-programmed into the Rom, as are the extra modes from the Acorn 540 and 14 new modes defined by PCATS itself. Most of these are desktop compatible, so any well written program will run as normal, but at the higher resolution, or with the larger palette.



ALL THE COLOURS CAN BE DISPLAYED ON SCREEN AT ONCE

New modes can be brought up using the entry field on the desktop's Mode menu. Several of the new modes are available on medium-resolution monitors as well as multiscans.

The unit was tested using NEC Multisync and Philips CM8533 medium resolution monitors. The standard modes worked fine with the enhancer card, as you might expect. The connection through the enhancer is effectively straight through. All the other new modes from PCATS, designed for group 0 monitors also worked correctly, although some of the high resolution screens, such as modes 123 and 124 were difficult to read. On the Multisync, resolution could go as high as 640 × 512 with a full 256 colours on screen at once. Mode 126 at 640 × 480 is of particular interest, since it mimics the resolution and colours of one of the Super VGA modes on the IBM PC.

Support of the desktop in new graphics modes is only part of the story. The enhancer also provides two further outputs which are not desktop compatible, but are available from Basic and other languages. These provide 12 and 16 bitplane, direct DAC modes, which in simple terms means 4096 and 65536 colours on screen at once, at resolutions up to 554 × 328 and 416 × 328, respectively.

Software support within the enhancer Rom consists of a number of star commands and SWIs. These provide facilities, among other things, to load and save an extended palette, to automatically set a palette equivalent to the default desktop colours and to load and save Clear files.

A Clear file, for those of you who do not know, is a straightforward uncompressed file format, which can handle high-resolution images with or without an appended palette. A full description of the file format is included in the documentation.

The documentation provided with the enhancer was in a prerelease form.

It gave ample description of the commands available and the modes provided, but it was a bit thin on the use of the software. This material will actually form the basis of an optional programmer's reference manual. A separate user guide will be provided with the podule, and this will include a tutorial and some programming examples.

Other software suppliers are showing interest in the card and names such as Clares, Longman Logotron and Lindis are looking into programming versions of their graphics software to work directly with the enhancer.

Overall the PCATS graphics enhancer provides a worthwhile upgrade to the graphics capabilities of the Archimedes, at a reasonable price.

The extra resolution and the addition of a much larger palette from which to select up to 256 colours is a major improvement over the machine's existing graphics capabilities.

The firmware commands have been well thought out, and the addition of a general-purpose graphics file format like Clear will allow a direct exchange of images between users.

PRODUCT DETAILS

The PCATS graphics enhancer for the Archimedes costs £179.95, and £189.95 for the A and is available from The Serial Port, Burcott Manor, Wells, Somerset BA5 1NH.

EasiWriter is the Arc's newest, and biggest, wordprocessor. GRAHAM BELL tried it out

The Arc has attracted a lot of innovative software – *Squirrel* and *Impression* are two good examples. But it has not so far persuaded companies to port software from non-Acorn machines. Icon Technology's *EasiWriter* is an exception: it's based on the respected Apple Macintosh application *MacAuthor*.

EasiWriter is a wysiwyg wordprocessor which makes full use of outline fonts and the other features of Risc OS. Unlike its major competitor *First Word Plus*, it uses proportionally spaced fonts and the Risc OS printer drivers, and can incorporate multiple columns of text and both *Draw* files and sprites into its documents. This places it firmly in DTP territory, but unlike *Impression* it's not able to hold more than one 'story' in a document. Colton Software's *Pipedream* is perhaps the only directly comparable application, though that has other strengths as a spreadsheet too.

EasiWriter allows multiple columns on one page

Installing *EasiWriter* is as simple as copying the lot onto a blank floppy or a hard disc, and starting up the software is easy enough: it installs an icon reminiscent of *Edit*'s fountain pen. The most important drawback of *EasiWriter* becomes immediately apparent here – it's the first mainstream application that won't run in a 1Mb machine. It claims 800k of memory at start up, more as soon as you edit text or run a spelling check. Even a 2Mb machine is a tight fit if you want to run it alongside any other sizeable application like *Paint* and you start including sprites in your documents.

The blank window contains a tool pane at the top plus a blank A4 sheet – you can start typing right away. Although the menu structure is daunting at first sight, EasiWriter is fully wysiwyg and it's simple enough to do a letter without a look at the manual. The tools allow you to select justified or ragged text, and insertion, deletion, search and replace work as you would expect.

PLUS POINTS

But there are some extremely neat touches at this simplest level. One is intelligent cut and paste: if you select a word and cut it out (using a double click of the mouse and CTRL-X as usual) the space around the word is adjusted intelligently, taking account of punctuation and so on. Pasting in a word elsewhere inserts spaces as necessary. Strangely the intelligence only works with CTRL-X – use DELETE and it can leave a double space behind.

Another plus point is that by editing a text file, items can be removed from *EasiWriter*'s menu structure, so simplifying it down to bare essentials for young users is possible.

Icon is a software company that doesn't have wide experience of the Acorn world, and occasionally it shows. There's no 'change case' key, to alter from lower to upper case. Similarly, 'delete forwards' and pointer hiding as you type were very late additions to the software after comments made during this review (the use of the COPY key to delete forwards is an Acorn quirk). More seriously, the treatment of a non-breaking space (ALT-SPACE) is wrong – *EasiWriter* can put a hyphen after a space this way.

Aside from these omissions, *EasiWriter* adheres admirably to the Risc OS guidelines. The document window works exactly as advertised, though some cursor movements can be unpredictable (particularly UP from the end of a paragraph). Various standard CTRL key shortcuts work as you would expect: CTRL-C copies, CTRL-V pastes, F3 saves, F4 finds and so on. There are four layers of function key shortcuts, which you'll gradually learn because they are marked on the menus too.

There is an 'undo' function for that injudicious key press. But it can even undo gross changes to the formatting of the entire document. There's also a spelling checker with the easiest way of creating your own dictionary I've seen: a 'learn' button. The while-you-type spelling beeps when you make a mistake, and you can let several mistakes pass before pressing F9 to correct them all. But don't go back to correct the last one – it forgets them all as soon as you move the caret with an arrow key. This needs to be fixed.

Sadly, you can't set up separate user dictionaries for, say, names and technical terms, nor can you add a thesaurus. Foreign dictionaries are available from Icon though, and you can highlight a word and define it as French. *EasiWriter* will then look it up in the French dictionary, or ignore it if no French dictionary is installed.

STRUCTURED TEXT

But this isn't *EasiWriter*'s only *forté*. It has a strong line on structure: as you type, you can divide your document into chapters, sections, sub-sections, bullet lists and so on using the menu or function keys. Each level of the hierarchy has a heading and body, each set up with different text styles. So section headings are initially 14 point Trinity bold, whereas the main section text is 12 point Trinity medium.

You can override these styles easily: you use the mouse to select an area of text and a menu allows you to choose the typeface, size (in whole points only), colour and so on, in the usual way. These local changes are termed 'emphases', but the system is exactly the same as the styles and effects in *Impression*. You can also change the default styles this way: set up a single paragraph with all the emphasis changes you want, then use the menu option to save the changes as a style. Saving using the original name (like 'Paragraph Style' or 'Section Heading') changes all the document. Saving the

WINNING WORDS

altered style using a new name allows you to set up two separate styles for section heads, for example. The first three new styles you create automatically get allocated a function key, so you can set up those styles quickly. You can also set up your own named emphasis styles.

There are two problems with this approach. In common with *Impression*, it's difficult to set italic or bold emphases. Because these are separate typefaces under Risc OS, if you set a whole paragraph in Homerton, *EasiWriter* won't automatically set any italics within that paragraph to Homerton oblique – they get left in Trinity italic. Second, and more avoidably, the style names are case sensitive, so you can have 'Paragraph Style' and 'Paragraph style'.

LOADING AND SAVING

EasiWriter uses its own file format, which isn't compatible with any other Arc software (nor with *MacAuthor*). But it can import and export plain text, from *Edit* for example (though you'll often have to get rid of the 'hard' new line characters) or to *Impression*. And it can import *First Word Plus* files directly, a smart move as this is likely to be a common upgrade path. It can't auto-import *View* files though: here you'll have to do a little work to set the file type to Text, and adjust the formatting as the line endings of the *View* file are kept intact.

EasiWriter's own files store things like the current position of the caret and the selected region as well as the text itself, so when you re-load a document, it opens exactly at the position you last saved it. They also include any drawings and sprites placed in the document – so unlike *Pipedream* there's no problem with separate illustration files.

You can also save 'stationery' files. These are exactly what you'd expect: blank templates which can contain preset styles, a logo, perhaps even some standard text. In an office, you'd typically develop stationery pads for letters, memos, forms and so on.

One of the special strengths of *EasiWriter* is the easy way of including graphics in your document. Big pictures, either drawings or sprites, can be included in two ways, as 'pictures' or 'figures'. The difference is figures have captions, which can be placed left or right, above or below the picture itself. You can control the scale and crop of each picture through the menus. You can also include 'in-line' pictures, which flow just like a word in the text. One example use would be to include formulae in the text, which you could design using *Draw*. The drawing can be put in the text at the cursor position, and moved up or down easily to align with the text. *Impression* has a similar facility (embedded frames) but *EasiWriter* works better in this respect.

TABLE CREATION

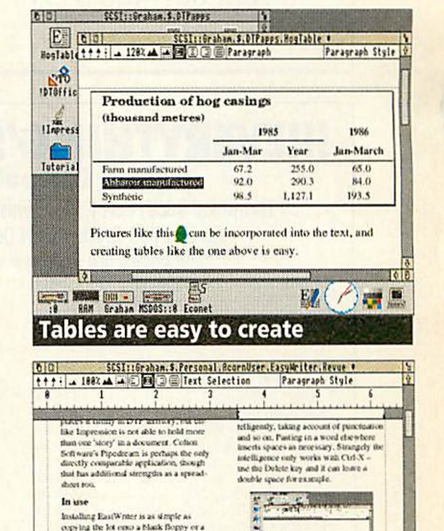
The other job that *EasiWriter* excels at is table creation. You can insert a table just like inserting a new sub-section or list, and typing items separated by Tab automatically creates as many columns as you need. This is one of the most impressive features of the whole application. As you type, the column widths 'magically' adjust themselves to fit your text. You can add rules within and borders around a table. In fact borders can be added to any text structure, so a section can be boxed off, for example.

Another impressive aspect of *EasiWriter* is its multi-column layout ability. You can set any document to have two or more columns, with or without vertical lines between them. A clever option allows the two columns on the last page to be balanced in length. However, options to change the position of headings to make them span both columns and to vertically justify the columns did not work in the pre-release copy reviewed: the bugs should be ironed out of the final version.

To make the layout more controllable, you can force text to the top of a page or to the top of a column, and insert flexible 'white spaces'. These are rather good – they can be set to any depth, and could allow you space to paste in a picture by hand on a printed copy, for example.

In all, *EasiWriter* is very capable. It offers almost everything most users want from a wordprocessor, and should prove popular in the home and in secondary education – despite its expense and the need for a 2Mb Arc. It's a little slow at most things (not unduly so) but is a far better choice that *First Word Plus* and is more useable than *Pipedream* for simple wordprocessing. Choosing it over a package like *Impression Junior* is much more difficult: it's considerably less capable in page layout terms, but for those who don't like fiddling with frames and rulers it could be a good choice.

But there are some important omissions: mail-merging, a thesaurus, footnoting, special treatment for quote marks (" and ') and easy sub- and superscript for example. Mailmerging is the most vital of these, and *EasiWriter*'s appeal to the business market will be limited until this is remedied. Icon says it's discussing mailmerge utilities with both Minerva (*MultiStore* and *FlexiFile*) and Digital Services (*Squirrel*), so the ability to link a database of names and addresses to a standard letter will emerge later. Icon also plans to release *TechWriter*, an upgraded version including built-in equation editing later in the year.



Tables are easy to create

Illustrations flow with the text

PRODUCT DETAILS

EasiWriter costs £176 from Icon Technology, 9 Jarron Street, Leicester, LE2 7DH; Tel. 0533 546225. Site and educational licences are also available. Foreign dictionaries cost £35.

WORLD CLASS

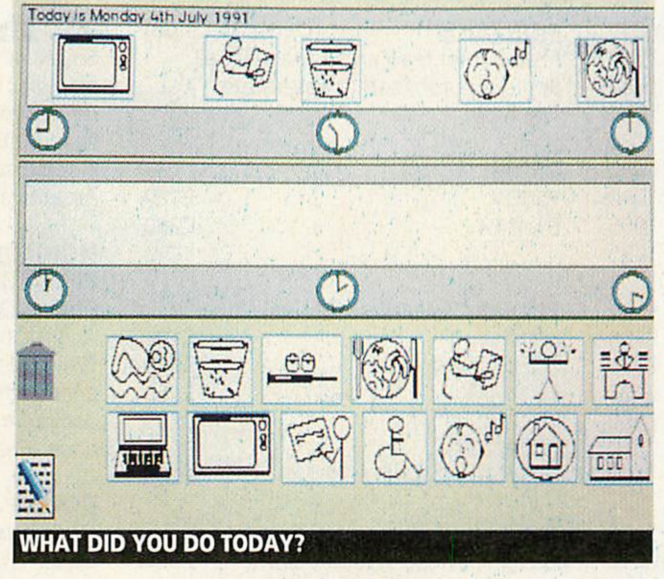
This new program encourages users to create a world of imaginative screens. **DAVE FUTCHER** goes exploring

Although it might sound like an ecological simulation, *My World* is, in fact, a framework which allows activities to be constructed for children of all abilities, right across the curriculum.

The software is a collaborative project undertaken by Regional East Midlands Information Technology (REMIT), a consortium of six local educational authorities. It was written initially to enable pupils with limited reading or writing skills to keep a diary of day-to-day events, using Rebus symbols. The aim was to fill in and print a diary to record the various activities, as well as produce a series of clock faces as a timescale.

My Diary, as it was called, developed into *My World*, and it now offers children far more than just a diary. An open-ended framework program has been created using the imagination of a group of seven advisory and support teachers and the creativity of a programmer and graphic designer. The resulting program is a powerful tool that can be used to tackle a wide range of classroom activities.

When the *My World* icon has been loaded onto the Arc or A3000 icon bar and clicked on, the title screen appears, along with a picture of the mouse, with the middle button highlighted and the message 'press menu'. The main *My World* menu appears on the screen and the See Screens option opens a new directory viewer which shows all the special screens. Moving the pointer to a screen and double-clicking loads that screen into the program.



WHAT DID YOU DO TODAY?

These different screens offer environments which can be explored and interacted with – tasks can be undertaken and the screen then saved and printed out. To focus the screen's use, there can be text messages giving information, or a prompt sheet can be written. One essential icon enables the child to enter text, while a second is a bin for the removal of graphics and text.

This allows children to move and copy graphic objects, and add appropriate text. By pointing at the graphic and clicking on Select, a copy of the object becomes attached to the pointer. It can then be dragged around the screen, leaving the original in place. When the copy of the object is where it is required, you press Select again and the copy is dropped. Once a copy has been placed, it becomes a movable object and, by clicking and dragging, children can refine their work more easily. Objects copied by accident can be removed by dragging them into the bin.

Text is added by pointing at the paper and pencil icon and a large text caret appears. Words, figures and punctuation can now be typed in – initially, this will be in the style of the screen heading if it has one, but by accessing the Text menu you can control how the text appears.

You can choose the type style (font), its size and its colour, decide whether or not it should be in a box and what the background colour of that box should be. Press RETURN and the text can then be dragged to the desired position.

The set of screens available on the distribution disc shows the package's versatility and flexibility. 'Frog' is a much loved screen featuring Mr A M Phibian, a frog of many parts, all of which are movable. The task is to pick them up and rearrange them, placing the labels in the correct positions.

The potential for working on a foreign language is shown by a screen called 'Le visage', in which a face is shown along

with a series of French words – l'oeil, le cou, le nez, la bouché, les cheveuz, les dents, l'oreille – the task being to move the labels onto the arrows pointing to the corresponding features.

'Dress', developed at Manchester Semerc in the early days of the BBC micro and the Concept Keyboard, is still used by many teachers, and 'Teddy' offers similar facilities with greater control by the mouse, as well as having the better graphics of the Arc.

Pattern making is an important part of the algebra attainment targets, in the early stages of mathematics in the National Curriculum. The 'Beads' screen, with the question 'What comes next?' and its three strings of beads to be completed, certainly provides plenty of pattern making experience. 'Triangles' also has possibilities for pattern work as well as being useful for making hexagons, fulfilling both shape and space attainment targets.

An excellent screen for communicating via symbols is the 'Weather Map'. This was developed as part of a language activity for primary children where they were presented with a written weather forecast and asked to create a simple weather map.

There are also three screens that deal with sentences:

- 'Sentences 1' requires children to create a sequence for making a cup of tea from a set of provided phrases
- 'Sentences 2' provides reading activities about types of shops, where children have to select a sentence to complete the opening phrase
- 'Sentences 3' is a language exercise where a sensible sentence has to be constructed from a jumble of words

'HTU' features Deines units, rods and flats used in many primary classrooms for hundreds, tens and units work. While this could be done better with real apparatus, you can combine pictorial representations of Deines apparatus with written numbers and language and print out the results, thereby taking a far more sophisticated approach to number work.

The BBC micro had a number of good packages that allowed shapes to be manipulated on screen to form simple pictures. 'Hexagon' provides a comprehensive kit of coloured, copiable shapes that allows children to explore pattern making. Within a totally different classroom context, 'Hexagon' could be a vehicle for some really challenging spatial work in mathematics.

In all, 21 screens are provided by *My World* and Northwest Semerc confirms that more will be available soon. However, as in all content-free programs, it is the ability to create your own screens that determines the quality of the program.

Screens are created within *Draw*, with a bit of help from *Paint*. Anyone familiar with the use of these two applications should have no problems. But to assist those who have not grasped these applications, the manual offers excellent tutorial help.

The section called Developing Screens will lead you through the creation of a screen, from adding objects to the backgrounds, to saving and testing the end product.

The distribution disc contains a screen called 'Basis' which can be used for all new screen development. It has a large area defined by a cream coloured rectangle, called the background. Another background area, called the print background, is displayed as a white rectangle, but this is only visible if the whole screen area is off.

Both the plain background and the print background can be group objects, so they contain a number of graphic elements which will be completely inactive. A screen may contain ready-made movable objects, but these must be separate and not grouped together, although individual objects can be grouped. The movable objects have to be in front of the print background. The icon group can contain just copiable objects, which can be any of the object types recognised by the software.

My World joins the elite group of truly content-free framework programs. It is a versatile program, providing a framework into which a teacher can put whatever content is needed. The program stores these contents on disc as screens ready to be recalled. It also allows age-appropriate topics to be covered at almost any ability level.

The provision of the wide range of example screens shows the potential uses of *My World*, but the scope of the package is only limited by the user's own imagination.

THE FROG SCREEN IN MY WORLD

MR A M PHIBIAN – ALL CORRECT AND PRESENT

PRODUCT DETAILS

My World costs £15 and is distributed by Northwest Semerc, Fitton Hill, CDC, Rosary Road, Oldham OL8 2QE.



SPEECH! CAN SPEAK THE CONTENTS OF ANY TEXT FILE...



...AND YOU CAN ACTUALLY UNDERSTAND WHAT IT IS SAYING

SOUND JUDGEMENT

SAM GREENHILL speaks well of the Superior Arc version of Speech!

Hold a chicken in the air, stick a deck chair up your nose, buy a jumbo jet, and then bury all your clothes... Well, don't really, but imagine these words, from the number one hit single *The Chicken Song*, being sung by your Archimedes or A3000. This isn't actually as painful as you might imagine, as I discovered when I used the song – released by Spitting Image a few years ago – to give Superior Software's new *Speech!* program the once over.

Speech! is an entirely hardware-independent speech synthesizer. The synthesizer module can be loaded on its own, but is automatically installed when the main *Speech!* application is run. The computer can be coaxed into talking in a number of ways – from the command line, from the desktop application or from Basic. The most noticeable feature of the *Speech!* module is its ability to verbalise English words in a direct text-to-speech translation. You can drag any text file onto the *Speech!* icon and listen to it speak the contents.

Although the standard text-to-speech feature is pretty good, *Speech!* tends to slip up on about one word in 10, causing the computer to make utterances that sound as though you've stepped on its foot. One way of curing this is to spell the word differently. For example, the word 'bury' is pronounced 'buwry' by *Speech!*, but spelling it 'berry' solves the problem.

Another solution is to use phonemes to build up words. A phoneme is 'a unit of significant sound', to quote the dictionary, and there is a phoneme for every type of sound. The 'a' in 'after' is one phoneme, the 'a' in 'acorn' is another. A catalogue of all the available phonemes is provided with *Speech!*, and by tediously referring to this, any word in most languages can be constructed. There is even a phoneme for the French rolling 'r' sound.

There are several parameters affecting the way in which a word is pronounced. Adjusting the 'tongue' and 'mouth' variables changes the second and lower formant centre frequency of the word. The only effect that my ears can pick up is that altering these parameters produces speech that sounds as though you are squeezing the computer's nose – or should I say 'node'!

On a more serious note, the pitch can be changed to enable the computer to sing. Each phoneme can be pronouced at any pitch over a four octave range. Incidentally, for those of you who already have *Speech!*, this is done by placing a number from the supplied musical-pitches-conversion table after each phoneme, and not, as the instructions seem to imply, by using the PITCH command. I think *Speech!* would have benefitted from a separate instruction booklet. As it stands, the directions are supplied on the inlay card and do not adequately explain the software. The Help file on the disc is more use.

I used *The Chicken Song* to test *Speech!* simply because I once synthesised that song using the Computer Concepts' speech chip in the BBC micro many years ago. In comparison, the quality of *Speech!* is better, but only just. However, I seem to remember that it was easier to sing a long note using the CC chip because you merely specified the duration for which the note was to be sustained. With *Speech!* you have to keep repeating the phoneme until enough time has lapsed and this causes problems with some sounds, such as 'OW' used in 'snow' and 'clothes': the result is 'cl - ow - ow - ow - ow - ths'!

Perhaps the best feature of *Speech!* is the separate dictionary application. With this you can build up a dictionary for words which the text-to-speech utility has difficulty with. Referring back to the 'bury' example, you could create an entry which tells *Speech!* how to pronounce the word correctly. Using wildcards and similar gadgetry, advanced rules can be defined for the pronunciation of certain words. You can even change whole words. Apparently, a computer columnist in the *Times Educational Supplement* uses the dictionary to make *Speech!* say 'Poll Tax' when it is asked to say 'Community Charge', and teachers use it to censor swear words!

Apart from the appalling arrogance of *Speech!* to assume that all users are ADFS-based in an increasingly SCSI-format world, I would say that this is by far the best software I have seen this year, largely because you can actually understand what the machine is saying. To prove it: I placed two volunteers where they could hear the computer but could not see the screen and managed to successfully converse with them by typing my answers into *Speech!*. It has even attracted commerical interest from a company specialising in car navigation systems.

PRODUCT DETAILS

Speech! for the Archimedes costs £19.95 and is available from Superior Software, Dept M1, PO Box 6, Brigg, South Humberside DN20 9NH.

MAKING TRACKS

ROB MILLER tracks down the most recent music application for the Archimedes

Music software for the Archimedes has been, and still is, thin on the ground. It Is a relief then, to see that a popular music package is being ported over from another machine.

Tracker, now up to version 1.00+++, has been around for almost a year, but is only just becoming popular, due to the increasing number of public domain libraries and bulletin boards offering libraries of ready made *Tracker* tunes.

Booting up *Tracker* in the usual desktop manner results in it being installed on the menu bar. At this point, files can be loaded by dragging them onto the *Tracker* icon. Clicking on this icon causes the desktop environment to disappear and the *Tracker* control screen to take its place.

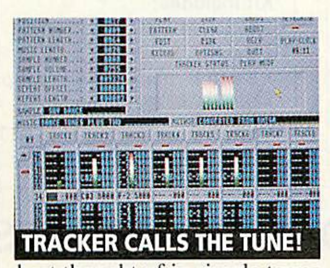
Because of the processor time required *Tracker* has been written as a single-tasking program, taking over the whole machine while it is being used. Any desktop applications are frozen at this point, yet it is possible to return to the desktop environment at any time by using the Quit option. Any programs that were running before switching over remain unaffected on the desktop.

Tracker originally appeared on the Commodore Amiga as *SoundTracker*, a four-track music sequencing program. As it was used extensively to write tunes for games and demonstrations there is a large library of music available.

It has been written to look and work like its 16-bit relative. Therefore *SoundTracker* music and sample files can be loaded directly into *Tracker*, provided that they are in the correct disc format.

HOW DOES IT WORK?

Any music created in *Tracker* consists of a number of patterns. These patterns can be arranged in any order, and repeated anywhere within a piece of music. Accordingly a typical tune may consist of Pattern 1, followed by Pattern 2, then Pattern 3 repeated three times, then Pattern 2 again, followed by Pattern 4. The patterns are best thought of in simple terms as choruses and verses.


TRACKER CALLS THE TUNE!

A pattern can consist of up to 64 events, stored in a sequential block. Each event consists of three parts: a note eg, A#, an instrument number and a command. The notes cover three octaves, ranging from C to top C.

Up to 32 instruments, or samples, can be loaded into *Tracker* at any one time, and over 100 samples are supplied for your own compositions. If you have access to an audio sampler such as *Armadeus* or the Armadillo podule, samples can be captured and loaded directly into the software.

The final part of an event consists of a command, plus data if relevant. The default command is '0' which actually has no effect, meaning 'just play the note'.

There are four commands that actually change a note. Arpeggio allows the pitch to be increased and decreased rapidly as it is playing. Portamento raises or lowers the pitch of a note, giving it a sort of slurred effect. Crescendo/Decrescendo has a similar effect as Portemento, but changes the volume. The volume can also be set to a constant level.

One effect that is really impressive is Set Stereo Position, which can be used to change the stereo position of any note while it is playing. A siren, for example, can be made to rotate from left to right to give it a big sound.

The tempo of any tune can also be altered while it is playing. This is useful if you wish to produce a piece of music requiring a mixture of simple and complicated patterns. Simple patterns can be kept short, taking up the same amount of time as complicated patterns played at a faster tempo.

Two final commands act rather like GOTO statements, and allow you to move about in a pattern.

There are a number of ways of putting music into *Tracker*. For those with MIDI keyboards (and podules), tunes can be played directly in real time. Users without MIDI can play tunes into *Tracker* using the computer keyboard. The less dextrous can type the notes in one at a time.

Tracker effectively acts as an eight-track recorder, each track occupying one channel. Resultingly you can have up to eight samples playing at once. However there is no option for playing more than one note at a time while inputting music. If you want a chord, you have to use three (or more) channels and play each note on top of the other.

Once a pattern has been set up notes can be edited and any effects added. Editing within a pattern is simplistic to say the least. The only option you have is to overwrite what is already there. There is no way of inserting a note between two others, or cutting a block of notes and moving or pasting them elsewhere in the pattern.

The overall tune editing also suffers from a lack of insert or cut and paste. There is no way of viewing the order of patterns in a tune other than stepping through a position counter in which only one pattern is shown at a time. Even a listing of a tune would have been sufficient.

Needless to say, editing can be the hardest part of constructing a tune. The way in which *Tracker* is structured and the way it is implemented lends itself to the creation of synthesiser music.The organised approach of some classical music also works well.

Tracker has a number of restrictions. These could quite easily be removed and the overall ease of use of the program enhanced with a bit of re-design. Due to the amount of computer time such a program would require, a desktop application is out of the question, though something a little more Arc rather than Amiga-like would be preferable.

At the moment *Tracker* is the only program of its type for the music novice and comes with four discs and a good manual.

For those who need convincing aurally, several tunes are included on this month's 3.5in disc. To load them, double-click on the *JukeBox* application and then double-click on the required tune.

PRODUCT DETAILS

Tracker costs £49 and is available from The Serial Port at Burcott Manor, Wells, Somerset BBA5 1NH.

MORLEY E·L·E·C·T·R·O·N·I·C·S · L·T·D



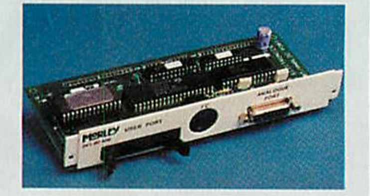
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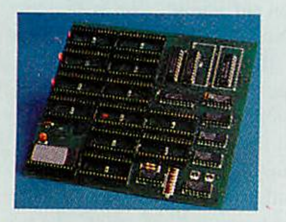
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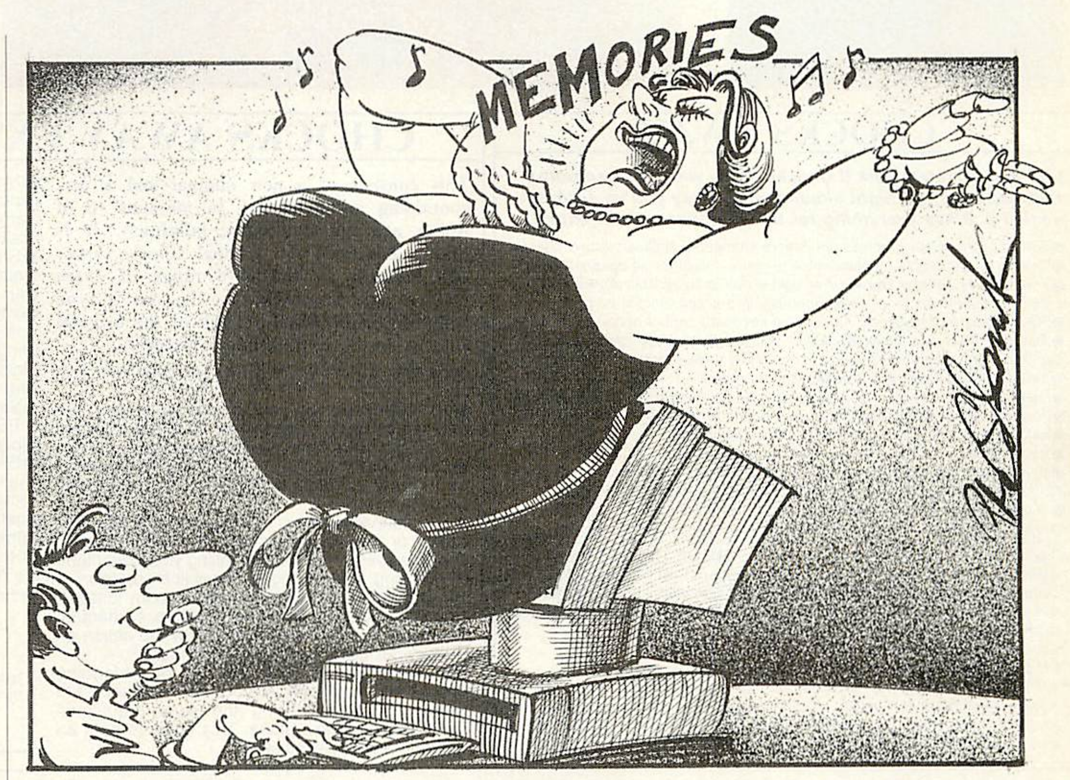
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KATE FARMER tells why upgrading your A3000 is so important if you want to fully utilise the power of the machine

RAISING STANDARDS



For those of you following the A3000 First Steps series you must have noticed Ram upgrades mentioned at one point or another.

When you consider the A3000 has one megabyte of Ram, then you probably think you've more than enough compared to eight-bit machines. However, it is becoming increasingly important to upgrade. Many software houses are now writing more complicated packages, and although most applications will run on a 1Mb machine, the more complex a package is, the more features you will want to use. For instance, *Impression* needs only 416K to run, but add to that your text, a few sprites and drawings, a printer driver, font cache, and you begin to see what I mean.

It's amazing the difference simply doubling your memory can make. *Paint*, *Edit* and *Draw* will run simultaneously and memory hungry applications such as *ADP*, *Poster* and *Schema* will become much more useful. Adding a further 3Mb means that your memory is a virtually bottomless pool, and you will be hard taxed to get a memory full error.

An 8Mb A3000 is still a pipedream, although its big brother can accommodate this huge amount. It also goes to say that memory at the moment is very cheap. Two years ago you would have expected to pay £180 for an extra megabyte – now you can buy it for around £70!

Eight-bit BBC machines have a memory map. All the memory is stacked up, 32K of Ram and 32K of Rom. This means you know what you would expect to find at certain addresses. Adding more memory to an eight-bit machine means either obtaining shadow Ram, which moves the memory taken up by the screen mode elsewhere, or adding another processor to control another chunk of memory. The A3000 is very different. Memory is shared out by the Memc chip. It may seem easy to you, sliding the Ram disc up and down on the task display, but the A3000 has to do some very complex memory management.

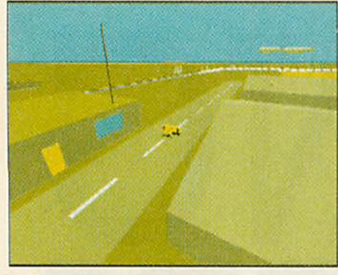
The concept of the A3000 memory system is that memory is a central resource. Imagine three children playing with building bricks. When a child wants to build a house he takes out the right amount of bricks from the box. Another child wants to build a bigger house, and he takes a few more bricks from the box and builds it. Now if a third child wants to build a house and finds that there aren't enough bricks to do so, it's your job, as the babysitter to make the first child take down his house and put the bricks back into the box. If you find this happens too often then the obvious solution is to buy more bricks. That is exactly what you do when you expand the memory of your A3000. But that's enough of analogies, what's the hardware like.

The A3000 was designed with a 1Mb upgrade in mind, and on the main PCB is a row of pins. A memory upgrade (which is about 15 × 2cm) simply slots onto these pins, and then when you turn your machine on you have more memory to play with. However, improved production methods have allowed more memory to be squeezed onto a single chip so 4Mb upgrades are now possible.

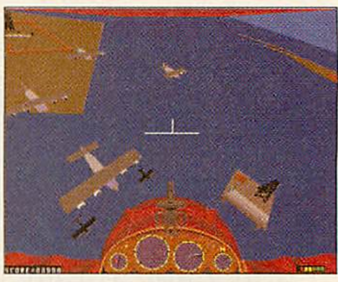
Some boards cannot be upgraded by the user – the Ram chips are soldered on. Others can be and upgrading from an extra 1Mb board to an extra 3Mb board is as easy as buying new Ram devices from an electronics shop, removing the old chips and plugging the new ones in. This operation doesn't mean removing the board. Upgradeable boards are about £20 more expensive but that will be absorbed when you buy the extra 4Mb. Atomwide even sells bare boards so you can find your own supply of Ram. Prices are changing all the time and the best thing to do when you consider upgrading is look through the advertising pages of *BAU*.

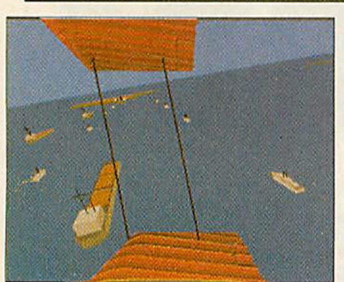
BBC A3000 / ARCHIMEDES / BBC A3000 / ARCHIMEDES / BBC A3000 / ARCHIMEDES

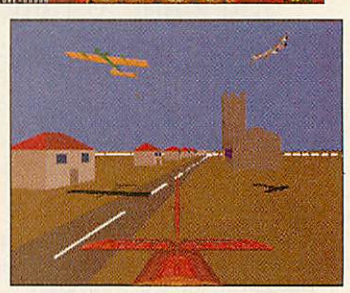
Chocks Away Extra Missions











CHOCKS AWAY

This new updated Mark II Chocks Away with supersmooth animation really is flight simulation the way you've always wanted it. It has everything for the beginner and the expert:

- Beautiful 256 colour graphics and 'nerve shattering' digitised sound effects
- Easy to fly, yet highly manoeuvrable bi-plane - ideal for all ages/skill levels
- **Revolutionary 2 Player Option** using split screen display. This allows 2 players to each fly their own planes simultaneously in practice, dogfights, or missions
- Full joystick, dual joysticks, mouse and keyboard control options
- **Amazing "Black Box Flight Recorder"** included so that you can record your own flights and then save & replay them. 90 minutes of totally absorbing pre-recorded training flights are included with the game
- Internal/External views of your plane can be selected from front/rear/left/right
- Powerful 30mm canon capable of very rapid fire and long range destruction
- Easy to read instrument panel and simple controls
- 3 very varied immense maps to explore - approximately 18000km^2 in total
- 20 fascinating and varied missions of increasing complexity are included with a promotion system from Cadet right through to Marshal of the RAF
- Superb range of targets/enemies including bombers, triplanes, fighters, tanks, control towers, anti-aircraft guns, head quarters and patrol boats

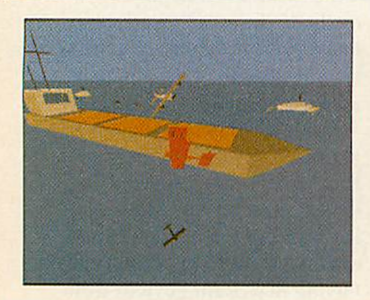
Chocks Away Mark I Version was awarded GAME OF THE YEAR 1990 by **Acorn User, A&B Computing (now Archimedes World), RISC User & Micronet**
"Graphics in the game are superb, smooth and with plenty of ground detail... this is a really enthralling flight simulator with plenty of variation and features to ensure longevity." **RISC User, Dec '90**
"Chocks Away is a delightful game." **Archive, Jan '91**
"Chocks Away is a brilliant game." **BBC Acorn User Dec '90**
"... It's a really great game, Playability 10. Value 10." **The Micro User, Jan '91**
"(Chocks Away Mark II Version)... The increased speed obviously makes the game more responsive and fun to play, well and truly overtaking Interdicter II as the best Archimedes plane game." **New Computer Express, Feb '91**

CHOCKS AWAY EXTRA MISSIONS

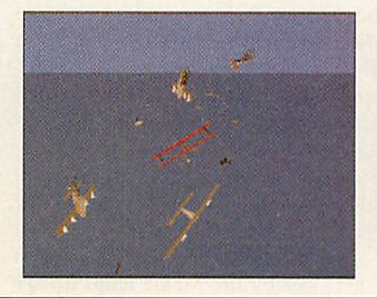
This consists of a new manual and a disc containing an additional 26 missions (6 of which are reconnaissance missions). It is loosely based on the original Chocks Away and features an extensive range of extra features and improvements. To run it, you will require the MkII version of the original Chocks Away. Extra features include:

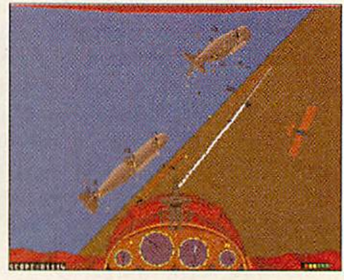
- 16 new & detailed maps based over land and sea.
- 20 enemy planes and 20 enemy targets are included in each mission. Over 1000 extra targets and planes have been carefully defined.
- Considerably improved action on all missions with plenty of targets to shoot at and plenty shooting at you.
- You can view the action from any of the enemy planes or targets and your own control tower at any time even while still controlling your own plane or watching a saved flight. There is a selection of tracking cameras (with adjustable zoom lenses!) around the playing arena. In addition a phantom plane can also be selected to follow the action on any or your black box flight recordings.
- Improved enemy pilots capable of performing loops, rolls, stall turns etc. All enemy planes are carefully modelled using the same equations controlling your own plane. This ensures both an accurate and fair simulation.
- More enemy planes and targets to shoot including: Three Engine Fighters, Enormous Cargo Planes, Airships, Barrage Balloons, Gun Boats, Oil Tankers, Trains etc.
- Six reconnaissance missions where you are required to take photos of various installations with your new on board camera.
- Improved graphics over the 16 maps including Complex Cities, Houses, Railways, Roads, Rivers, Bridges, Lampposts, Railway Stations, Oil rigs, Piers, Beaches, etc. to mention but a few. In total over 100 different graphics have been defined.
- Serial Port Link Up option so that you can link up 2 BBC A3000 or Archimedes computers and 2 pilots can fly simultaneously in full screen mode.
- Extensive enemy flak guns and improved enemy plane guns help make the new missions both more interesting and challenging to say the least!
- Improved digitised sound effects plus, of course, all the extensive options which are available with the original Chocks Away.

WIN a superb......
"Radio-Controlled Biplane"
Successful completion of all 6 Reconnaissance missions will allow you to enter this competition
TALLY HO GINGER!









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CHOCKS AWAY (Mark II Version with 1 or {split screen} 2 player options)	£24.95
CHOCKS AWAY EXTRA MISSIONS (With 2 player Serial link option)	£19.95
CHOCKS AWAY COMPENDIUM (Chocks Away & the Extra Missions)	£39.95
CHOCKS AWAY NETWORK (Econet and Eclipse Midi Podule - Ring for availability & Price)	

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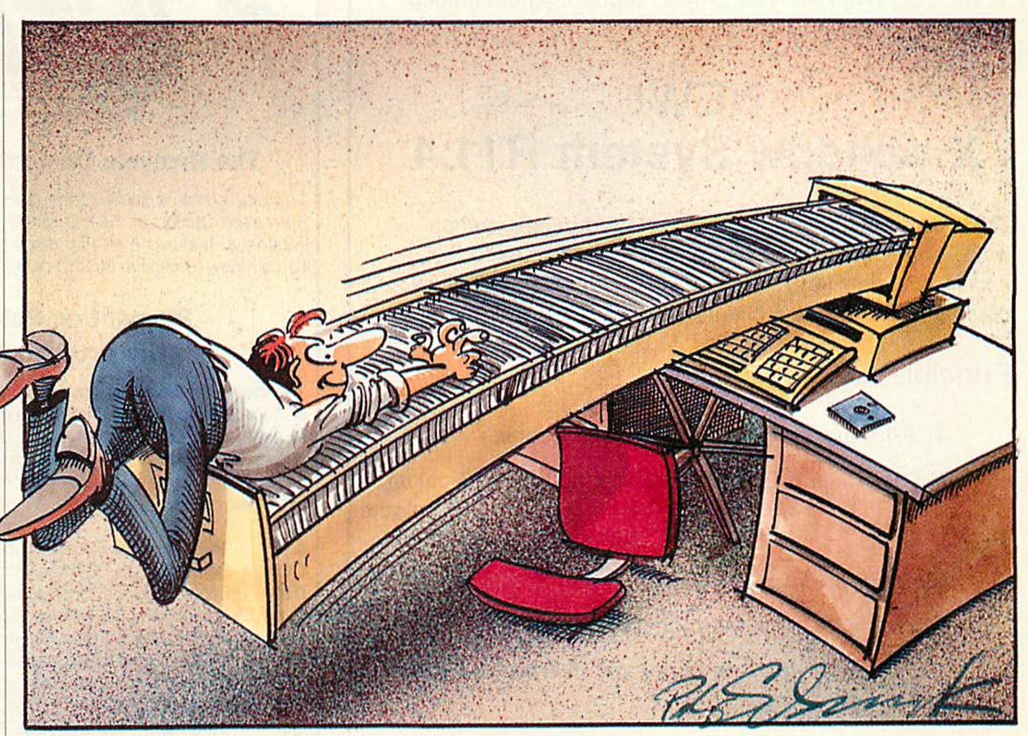
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FILING A SUIT

DAVE FUTCHER discovers a package that helps you make use of the hidden memory in your eight-bit computer

There have been many attempts to provide the eight-bit BBC micro with more than the 32K of Ram it was originally designed with.

First came the idea of shadow Ram developed by Aries which provided 20K of additional memory which was an attempt to provide additional screen memory to support graphics. Some people also exploited this memory for data storage with the *FX111 that Acorn allocated for switching between the two Ram areas.

Another solution was the addition of a 6502 second processor which pushed the BBC's available memory to 44K for Basic programs and 61K for machine code. Then Solidisk came along with sideways Ram, which was originally used for running Ram images of sideways Roms, but eventually became used for storing programs and data too.

Many people who bought the 80186 co-processor for access to the world of IBM PC compatible computing often wondered if they could access the half a megabyte of Ram sitting unused on their co-processor board to rescue them while they struggled with their limited BBC Ram memory.

Access to this 512K is now possible, thanks to an innovative product called the Co-Processor Filing System (CPFS) from Essential Software. This is a new filing system which allows the memory of a Master 512 co-processor to be used as a Ram disc by the BBC micro when operating in the native mode. The filing system also needs one page of private workspace to operate, which means that in a model B it will raise the value of PAGE by &100.

CPFS is contained in a 16K Eprom which must be plugged into a vacant Rom socket in the BBC micro. It cannot be run in sideways Ram.

With CPFS installed you harness the 512K for all sorts of work with your eight-bit BBC. Complete commercial applications can be loaded into the Ram and their files can be loaded and saved. Datahandling using CPFS is tremendous, with virtually everything – searches, sorts, extracts and merges being accomplished at great speed. It's ideal too for desktop publishing tasks using packages like Watford Electronics' *Wapping Editor* as screen scrolling operates as fast as in normal wordprocessing. Amazingly too, this is achieved in complete silence with no more noisy disc access as parts of the page are loaded. Wordprocessing also benefits; the multi-file mode in *Interword* improves considerably using CPFS.

All the filing system commands recognised by the Mos (ie, the common commands) are available in CPFS. You can therefore use *LOAD, *CAT, *SPOOL etc, just as you have always done and you can *RENAME files and use *ACCESS to lock and unlock files.

Users of CPFS do have to remember that all the data stored in the Ram disc is lost as soon as either machine is turned off. Also, when the second processor is used for its original purpose, the same memory as CPFS uses for files is used, so any data stored in the Ram will be corrupted if the Tube is turned on.

The *TRANSFER command is available for transferring files from one filing system to another. This is similar to the Master's *MOVE command, but is faster and considerably more flexible. It can be used to copy a file or a number of files from a directory in one filing system to a given directory on another. It can also be used to copy all the files in the CPFS memory disc onto a physical ADFS or DFS disc. *TRANSFER requires five parameters, but because it would be easy to make mistakes if you entered them all in a single command line, you are prompted for each parameter as it's needed.

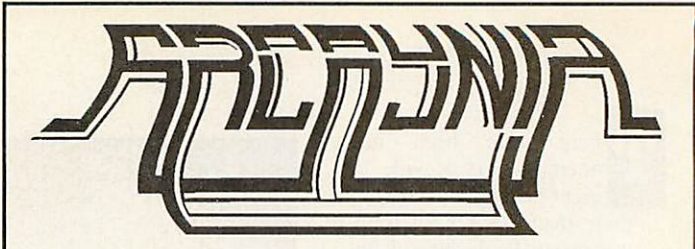
The Ram disc can hold up to 127 files. Filenames can be up to 10 characters long and can be grouped into directories, but as in DFS, directory names are single characters which appear as part of the filename.

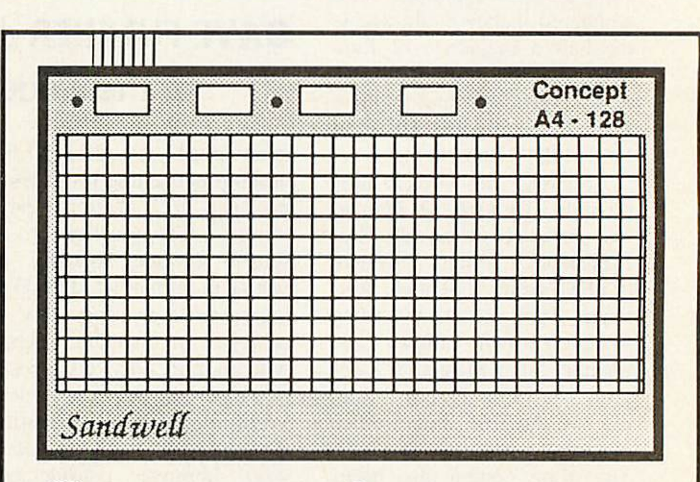
It is worth noting that a CPFS directory can contain more files than in other filing systems. A DFS disc (one-sided) normally contains only 31 files. An ADFS directory has a maximum size of 47 files. There are applications like *Interword*, for example which sometimes display the contents of a directory. These programs can't handle more than 47 files at once. If you are using an application like this with CPFS then it is up to you to make sure that there are no more than 47 files in any single CPFS directory.

CPFS is an essential product for anyone who has a 80186 co-processor sitting inside their Master 128 or alongside their BBC model B. Just type *CPFS and the 512K laying dormant is unleashed, ready for you to exploit. It is easy to use, unlike some memory enhancing hardware products. The 25-page documentation is supplied as a text file and covers everything you need to know.

PRODUCT DETAILS

CPFS for the BBC model B, B Plus and Master 128 costs £25 from Essential Software, P.O.Box 5, Groby, Leicester LE6.


ARCAYNIA


Concept
A4 - 128
Sandwell

THOROUGH INVESTIGATION

There is a new package that allows you to copy software. But, asks **MAT TIZARD**, is that such a good idea?

From the depths of Somerset comes the latest version of this powerful disc editing and backup utility. There have been several improvements on the first release of *Investigator*, and the package is now more versatile and efficient.

The main utility installs on the icon bar, but does not run in Risc OS, instead it fades elegantly into its own work screen when clicked upon. It contains several facilities, the most useful of which is to be able to make reliable copies of 99 percent of your discs either byte for byte, or through the use of DiscDump files, which is a useful and ingenious way to keep backups of all your important software and data.

It reads in all the data from your source disc, and also the information concerning how it was originally stored, and compresses it all considerably. This effectively means that you can safeguard yourself from losing your software without incurring the loss of storage space normally associated with keeping comprehensive backups.

The straight copier doesn't manipulate the data at all, it simply duplicates it by brute force! Both it and the DiscDump methods can cope with a wide variety of disc formats: Archimedes, PC (MS-Dos), in fact anything that can be read by the actual hardware in your Arc's disc drive. The reason for this is that the program deals with the physical format of the disc, not the logical format. The physical format is the way information is stored on the actual surfaces of the disc as magnetic codes, while the logical format is the layout of files and directories, something which is different for all makes of computer.

This therefore enables people who own more than one computer system (including an Archimedes) to use their Arc, by running *Investigator,* to make compact backups and store them as DiscDumps on a hard disc, giving a complete, self-contained repository of data. Also included in the package are various utilities to decompact text or datafiles from your DiscDump files. This opens up a whole new sphere of information from other systems, which can be transferred using the program, and appreciated by the ever growing army of Arc users.

When the data has been read in from the floppy disc it can be held in memory, and edited by hand. Future versions would do well to include a facility to search for strings on the disc, especially as this would greatly enhance the usefulness of the editing routine. Another useful feature is the ability to examine (but not alter) the format and ID information concerning the layout of data on your discs. This has the power to detect (and sidestep) corrupted or fishy areas. A clear, lucid visual display keeps you up to date with the progress made through reading or writing the disc, and a useful help facility enables you to simply point at any of the utility icons on screen to be presented with a description (or diagram) of what it does.

In the course of examining this package I once again had to personally confront the legal and moral issues connected with the copying of software.

The very real moral dilemma of software duplication has by no means been resolved yet. Additionally no adequate legislation exists to clarify this area, and nor would it be rigidly enforceable even if it did.

Along with access to personal data stored on computers and computer viruses, comes the intriguing and thorny debate of precisely when a user has the right to make a copy of a piece of software. Obviously, unless the software is public domain (itself another much maligned umbrella term) or is otherwise exempt from the norm, it must be the property of the person making the copy. That much is common sense, and is legally defined. Things are less clear however when one contemplates what right the purchase of information gives a buyer to make a backup copy for his own personal use.



MAKE BACKUPS OF YOUR SOFTWARE – NO PIRACY PLEASE!

In an age where the exchange of information as a commodity is becoming increasingly valuable and relevant to every one of us, I think these questions must be more thoroughly addressed if we are to avoid unwittingly breaking the law in the future or even being tempted to do so through insufficient restrictions.

Meanwhile, anyone with a conscience should not need telling that the act of software piracy, which is not as glamorous at its name suggests, merely deprives software publishers of the funds to provide a better service to us all, and ultimately pushes up prices to compensate for individuals' irresponsibility.

Having said that, I am confident that the vast majority of people would not consider abusing the privilege of being able to safeguard themselves from losing their software. If software piracy does become a serious problem, no doubt steps will be taken to withdraw that privilege, and nobody wants the atmosphere of mistrust that will result. *Investigator* is an excellent utility, and serves its purpose well.

PRODUCT DETAILS

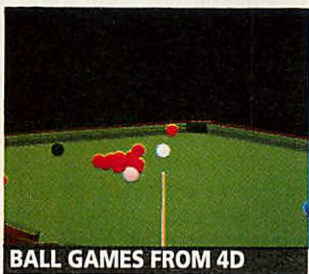
Investigator costs £27.95 and is available from The Serial Port, Burcott Manor, Wells, Somerset BA5 1NH.



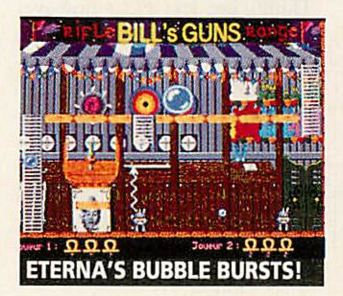
GAME SHOW



CHOCKS AWAY NOW HAS SOME SNOWY MOMENTS



BALL GAMES FROM 4D



ETERNA'S BUBBLE BURSTS!

I've got to be quite brief this month. There's so much to say, and I get so little space to say it in...

I've managed to obtain an early copy of the *Chocks Away Extra Missions* disc from The Fourth Dimension.

It's got some pretty remarkable new features, including convincing snow, thunderstorms and, best of all, a network of 'cameras' scattered around the map from which you can view your own plane. You can even fly in 'The Phantom Plane' when replaying a saved flight, which is essentially like buzzing around inside a flying video camera to keep up with the action!

Also (and at my suggestion) 4D has implemented a fast-forward feature in the normal flying mode so that time simply 'flies' over long distances! Watch out for a full review when the new game is fully finished.

I've also completed a few laps with *Saloon Cars*, the latest driving simulator from 4D. Though not finished, it's very good to date.

It certainly puts *Powerband* to shame, especially with regard to some of those little 'extra' touches, such as the whole screen bouncing as the car goes over a bump.

The Silverstone and Brand's Hatch tracks have been meticulously recreated in the simulation, except for a slight hiccup regarding Silverstone. Anyone who knows anything about racing will know that this world famous track spent its Christmas holidays covered in bulldozers. The track is now more than slightly different and 4D is back at the drawing board, having quickly decided that the original Silverstone course in *Saloon Cars* will have to become the 'nostalgic practice track'!

4D is also working on a game called *Enter the Realm* which has been loosely compared to *Shadow of the Beast*. It is reputed to have a plot involving knights in a strange land or something like that – I don't think 4D itself really knows what it is yet!

One of the next releases from 4D will be the snooker and pool game *Break 147* and *Superpool*. Author Gorden Key (*E-Type*, *Apocalypse*, *Powerband*) is recognised as generally a very good games programmer in the Acorn games circle, but is also renowned for his rather 'odd' taste in colours – just look at *Apocalypse* to see what I mean. Critics are therefore intrigued to see how the balls turn out in *Break 147* and *Superpool*, due out this month.

But enough of 4D. Isn't anyone else doing anything? Well, as a matter of fact....

I guarantee that if you like to keep in tune with the Acorn games world then Krisalis Software is a name that will soon be firmly etched in your mind. Nothing's definite (is it ever?) but feast your eyes on the following list of possible Archimedes games for the coming year:

Manchester United Football Club 2: The sequel to this popular game will include a

rather less complicated management aspect for those of you (and me!) who were somewhat daunted by the original. The computer footballers will also show a marked improvement vis-a-vis tactics, and the goalie will be user-controllable (oh dear, I was quite happy to let the computer handle that bit!). This will all be complemented by smoother animation.

Mad Professor Moriarti 2: In this sequel, the professor must break out of a place he recalls well from the original – the loony bin! The plot takes place in the hospital and the first puzzle is solved by sticking a hypodermic syringe in the professor's cell guard....

Jahangir Khan's World Championship Squash (why can't Krisalis think of names less than 10 syllables?).

This will be squash's answer to *Manchester United FC*, combining ball bashing (brawn) with managerial skills (brain), but with only two players and confined to a small room resembling half a tennis court. The Amiga version of this game has been acclaimed in recent reviews. Archie owners might see it before the year is out.

French company Eterna is making serious inroads into the Archimedes games world, releasing *Blaston*, *Fine Racer*, *Bubble Fair* and *Rockfall* any minute now.

Bubble Fair looks interesting, the object seeming to be to burst bubbles and... er.. that's it! Good fun so far though. Watch out for further news and reviews on these in coming months.

Well that's it for this month, but just remember: Christmas 1991 is going to be the Christmas that wipes the smile off the Amiga buff's face.

Sam Greenhill

ARCADE GAMES CREATOR

Alpine Software. Tel: (0762) 342510.
Archimedes £38.95.

New from Alpine Software comes the *Arcade Games Creator*. This allows those with little or no programming knowledge to create games which can then be run independently of the creator itself. The system is flexible and, with a little patience, it is possible to design a respectable arcade adventure, shoot-em-up or whatever takes your fancy entirely from scratch.

The program is supplied on two discs and runs from the desktop, giving an impressive ease of use. Even so, quite detailed planning of your game is necessary before you start to design it on the computer. Objects (such as invaders, or breakout bricks) can be placed on any one of a total of eight levels of parallax which, in conjunction with the built-in starfield feature, allows for convincing motion in a large depth of field. The sprites for these objects may each contain up to 12 frames of animation, and can be made to follow any path through the level on which you are working.

The key to the whole system is the event-handler, which is where some degree of forethought is advisable as the details of exactly what happens to each object when it collides with any other, or when a key is pressed have to be entered in.

By building up the components, and adding different levels with background sprites, sound effects and music, you can create something very worthwhile.

A lot of thought has gone into making the system as versatile as possible. Features such as gravity, automatic screen-syncing and stereo positioning of sound effects have all been included. To find out more about the package, a demonstration disc is available. Simply send an A5, 27p SAE to Alpine to receive this.

Mat Tizard

SQUARE ROUTE

Computer Eyes. Tel: (0622) 751096.
Archimedes £19.95.

Just when you thought the *Tetris* theme had been squeezed dry, along comes another block-fitting game, with the simplicity and addictiveness of its predecessor.

Square Route is based on a grid, onto which you must place a certain number of different shaped pieces, within a certain amount of time. Some squares on the grid affect things like the time limit. Other squares allow shapes to be placed upon them, but increase rather than reduce the number of shapes left.

Level one is quite simple as there is a lot of space to fill and not that many pieces to use up. On later levels, grids become smaller, making them harder to complete.

Further into the game, 'bugs' make life harder by eating the shapes you've already placed. Occasionally they regurgitate shapes onto the grid (this is not as nasty as it sounds) thus helping you. Bombs destroy areas of the grid, but these can be diffused if you are quick.



SIMPLE ADDICTIVENESS

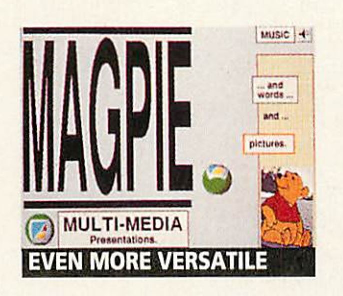
The game makes use of mode 13, 256 colour graphics, for a colourful display. A nice touch is that shapes are translucent, rather like green glass, so the background shows.

Although 256 colours are used, the rest of the graphics have a distinctly, dare I say it, Atari ST feel. On the other hand, there is a limit to what you can do to the graphics in this kind of game while keeping things clear and simple.

Sound is a mixture of the now 'compulsory' *SoundTracker* tune and, a collection of whizz, pop and bang sound effects. The music is a bit disappointing as it only plays during the high score display. Perhaps something a little more lively to get the adrenalin going would have been more appropriate.

Square Route falls into the 'simple to play but difficult to master' category. Addiction is virtually guaranteed, with a massive 250 levels to complete and that essential 'one more go' element keeps you coming back for more.

Rob Miller



FLYING HIGH

DAVE FUTCHER looks at the latest version of Magpie and discovers a number of first class improvements

Since its initial release a few months ago, *Magpie* from Longman Logotron (see review in *BAU* March 1991) has provided BBC A3000 and Archimedes users an easy to use and sophisticated means of storing and presenting material. This has been achieved through the concept of pages stored in binders, rather like the way the Apple Macintosh hypertext program, *Hypercard*, uses stacks.

The author has continued to improve *Magpie*, and a new version has just been released. There have been three major changes. *Magpie* now offers carousel facilities that are ideal for presentations. Then there are skeleton pages, which allow the user to allocate resources to a number of pages, therefore easing the building of *Magpie* binders. Finally there is greater control over the type of windows created within binders.

An essential for any application that stores text and graphics is the ability to display pages in a rolling sequence. The original *Magpie* did not, but a carousel feature has now been added so you can repeatedly present a series of pages. One page, a sequence of pages or a whole binder can be made to automatically turn to the next after a specified delay. It works rather like an automatic slide show – ideal for a presentation at a school Open Day.



STYLISH PRESENTATIONS

Normally when a page is turned to, its entire contents are redrawn, after first drawing a blank piece of paper in the required colour. An option is also available to overlay pages. This means that the new page is a transparency laid on top of the previous page. This is excellent for building up a diagram piece by piece.

SKELETON PAGES

Master pages are already a common element within desktop publishing, where a defined page layout is used as the basis for all subsequent pages in the chapter. Now *Magpie* offers a similar concept – skeleton pages. Just like master pages, skeleton pages are used when you need several pages in a binder to have a similar appearance. You can also use them where you have large items like a picture or a sound used in several pages.

Using this concept certainly makes the construction of *Magpie* binders even easier, as you can replicate page layouts or use a pre-defined layout across several pages.

Magpie's skeleton pages are more powerful than DTP master pages because it is possible to create a sequence of skeleton pages that actually look quite different. This is because all the items on a skeleton page can be moved, resized and their behaviour changed for the page they are used on, yet each page uses the items from the skeleton page and no copy of them is placed on the actual page. Such moving or alteration affects the skeleton items on that page only.

Magpie runs very effectively within the Risc OS window environment and at times the scroll bars and other window furniture can be most useful if you want to hide parts of the page from the user and allow them to scroll down to them. At other times, the vertical and horizontal scroll bars are not needed, so there's a new option within the Page Preferences dialogue that allows you to specify the style of window to be used to display the page.

There's also the possibility for keyboard presses to be used to turn binder pages. Instead of using the mouse to click a page, the PAGE DOWN and PAGE UP keys can be used. Hide and reveal actions can also be keyboard linked and this has great significance for the interfacing of a Concept Keyboard to *Magpie* binders.

Magpie's original 75-page documentation is supplied with the new version, but to cover the improvements a second, 12-page manual is supplied. The program disc contains the new 1A.00 version of *Magpie* and *MagpiRead*. *Introducing Magpie* has been extended by adding new binders.

The real power of the changes are shown in two binders. In a 39-page binder called The Word, the carousel feature is used to create the animated build-up of a single word, while Bounce shows the power of the new *Magpie* for combining pictures, words, music and animation into a multi-media presentation.

MagpieZine is the first edition of a freely copiable magazine containing ideas and curriculum resources.

Magpie was already a winner! It is a powerful information organiser. It now has even more versatility, whether you are storing pictures and text in a binder, building up a project folder, creating a simple demonstration sequence or a full blown presentation.

The new version is free to existing users – will other software publishers follow suit?

PRODUCT DETAILS

Magpie 1A is available from Longman Logotron, Dales, Brewery, Gwydir Street, Cambridge CB1 2LJ. It costs £54 (free to existing registered users).

If you haven't seen Longman Logotron's 1991 catalogue, chances are you aren't making the most of your school's software budget. Consider these brand new programs for the Acorn Archimedes:

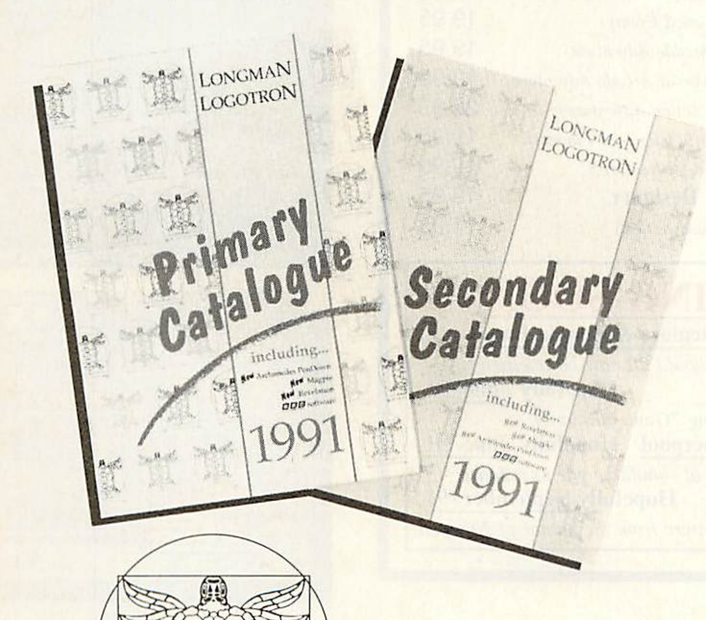
- **Pendown**, a word processor designed specifically for education, with a range of new features offering control as well as freedom
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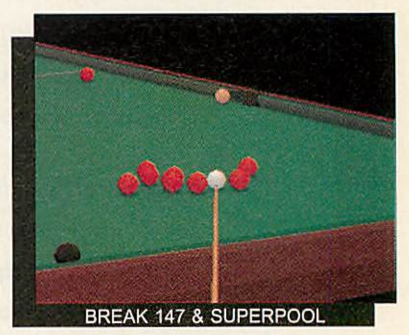
2. AW 5-91

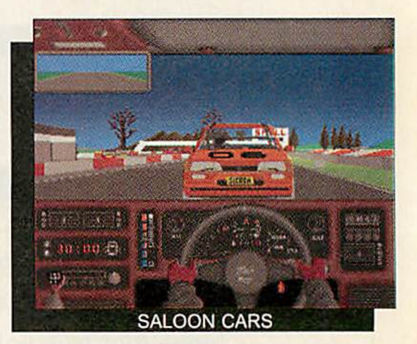
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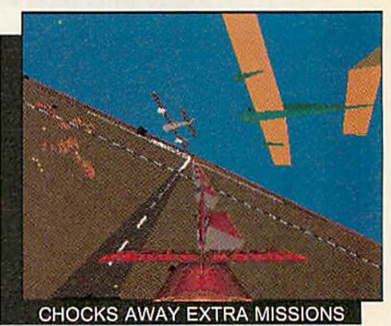
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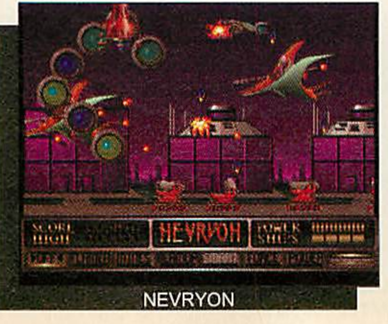
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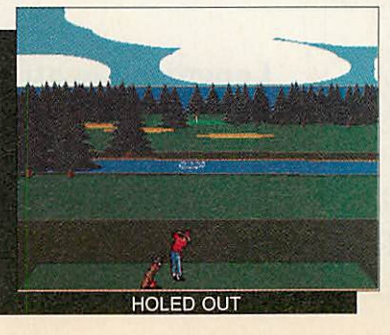
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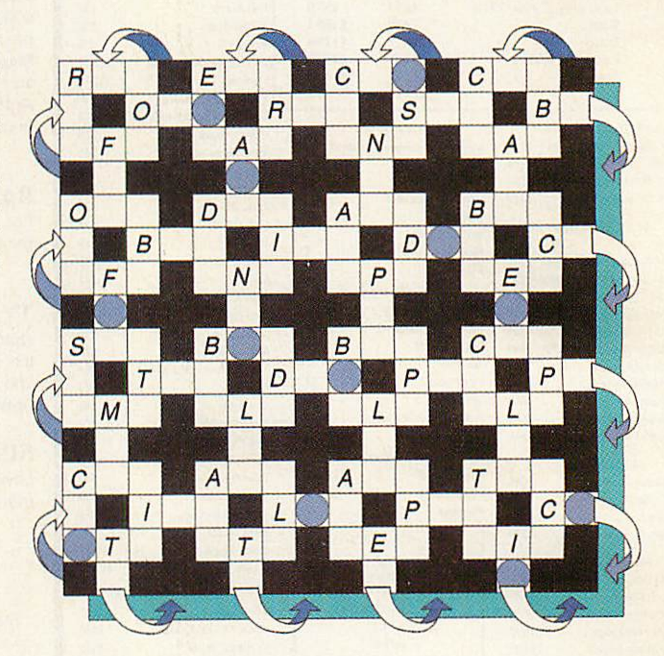
ACORN USER ADVERTISEMENT PAGES – JULY 1991

BBC Acorn User July 1991 Prize Jigword Competition

£25 CROSSWORD PRIZE

The box below contains 96 three letter abbreviations, all of which have something to do with the BBC or Archimedes. This month's competition is to try and fit all of these words into the grid on the right. We have filled in some of the squares to give you a start. Note that eight words 'wrap round' off the right or bottom of the grid and their last letters appear on the left or top of the grid. When all the words have been fitted, the circled letters will form an anagram of something do to with computing. Simply write this on the back of a post card or sealed envelope and send it to 'July Competition' at the usual address. The winner will be the first correct solution out of our hat on 10th June. Good Luck!

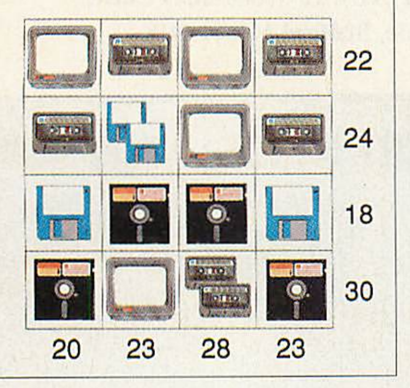
ABS	ACC	ACS	ADC	ALU	AND	ARM	ASC
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BMI	BNE	BNV	BPL	BRA	CAD	CFS	CGA
CHR	CLD	CLG	CLI	CMP	CPU	CPX	CPY
CRT	CSD	CTS	DAC	DCB	DCD	DEC	DEF
DEY	DIR	DIV	DLI	DPI	ECF	EOR	EQU
ERL	ERR	FIQ	FOR	IIC	INC	INT	INX
LCD	LDA	LDR	LDX	LED	LEN	LET	MFM
MLA	MOS	NFS	NOP	OCR	ORA	ORR	PCB
PHX	PIN	PLA	PSU	RAD	RAM	RFS	ROL
RSC	RTI	SBC	SID	SQR	STA	SUB	SYS
TEQ	TSX	TTL	TXA	TXS	TYA	ULA	URD



Crossword set by Trajanus

FOUR-SCORE

If each row and column adds up to the totals shown, what is the value of each symbol?



WORD CHAIN

Turn PAINT into TOOLS changing only one letter at a time. Each step must make a proper word.

PAINT

_ _ _ _ _

_ _ _ _ _

_ _ _ _ _

_ _ _ _ _

TOOLS

ONE LINE GAME

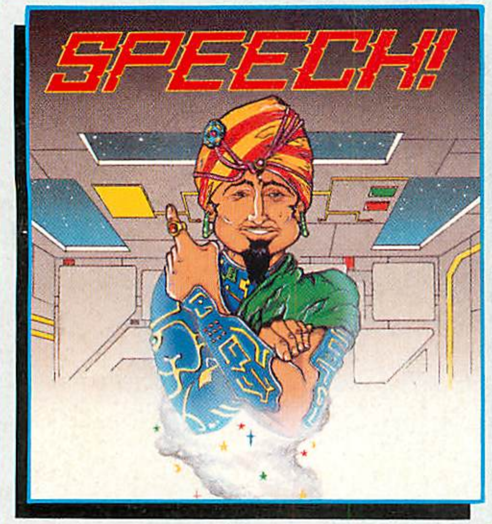
Deep within an x-radiation reprocessing plant on the distant planet of Ekans, particles of sub-molecular radioactive material are produced as a by-product of the reprocessing. These particles need to be removed from the reprocessing chamber otherwise, well, let's say it would be very messy (and rather expensive). It goes without saying that humans could not withstand the immense pressure, radiation and overpowering odour of a persistently malfunctioning 'citrus grove' air-freshening plant.

To get round this problem, a cybernetic 'snake' has been constructed, and thist is capable of entering the chamber without harm. The snake must be guided by a human to collect the radioactive material as it is produced. The snake itself cannot do anything with the material, so instead it genetically replicates enough of its 'tail' to store the dangerous by-product. For this reason, it is essential that the snake does not collide with its tail – remember what we said about 'messy' and 'expensive'?

If you would like to try your hand at x-radiation reprocessing, type in the single line opposite (which has been split at colons to aid legibility) taking care not to add any extra characters. When RUN, use Z and X to steer the snake left and right, you'll be rewarded with a fanfare for each particle safely collected. Archimedes users will have to use *65Host*. You can vary the 10 in A=INKEY10 to make the game easier (or harder!)

```
10MO.7:
  REP.V.-1:
  U.VP.=22:
  V.284;20,294;12:
  S=&7D7B:
  E=S:
  T=&70:
  !T=&275029:
  REP.REP.N=H.+RND(800):
  U.?N=32:
  P=P+5:
  TI.=0:
  REP.A=INKEY10:
  D=(D-(A=88)+(A=90))A.3:
  S?-999=D:
  ?E=32:
  ?S=-1:
  ?N=42:
  S=S+D?T-40:
  E=E-(TI.>60)*(T?E?-999-40):
  U.?S>32:
  V.7:
  U.S<>N:
  P.P
```

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A3000/Archimedes


A3000/Archimedes

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The new A3000/Archimedes version of SPEECH! is fully RISC OS compatible and allows multitasking in Desktop. You can vary the pitch, speed, volume, and voice, both directly and in your own text files and programs, and can even 'sing' words over a four octave range! The A3000/Archimedes version also includes a program so you can alter the dictionary yourself.

BBC Micro/Master & A3000/Archimedes

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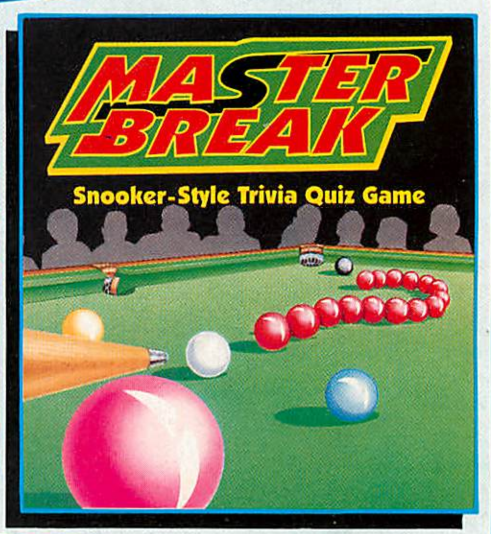
Start your frame with an easy red question, then choose your colour - have you the nerve to choose the black ball question? You've used all your PASSES and the ball is OVER THE POCKET - if you miss, it's a FOUL SHOT!

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BBC Micro/Master, Electron & A3000/Archimedes


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